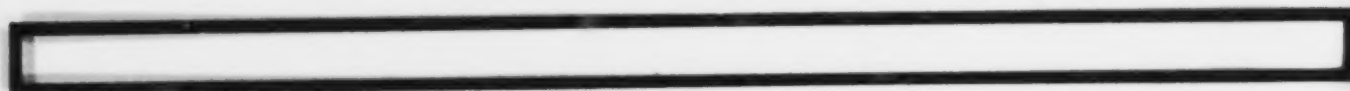


Toxics-Release Inventory: A National Perspective, 1987

(U.S.) Environmental Protection Agency, Washington, DC

Jun 89



U.S. Department of Commerce
National Technical Information Service



United States
Environmental Protection
Agency

Pesticides and
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(TS-779)

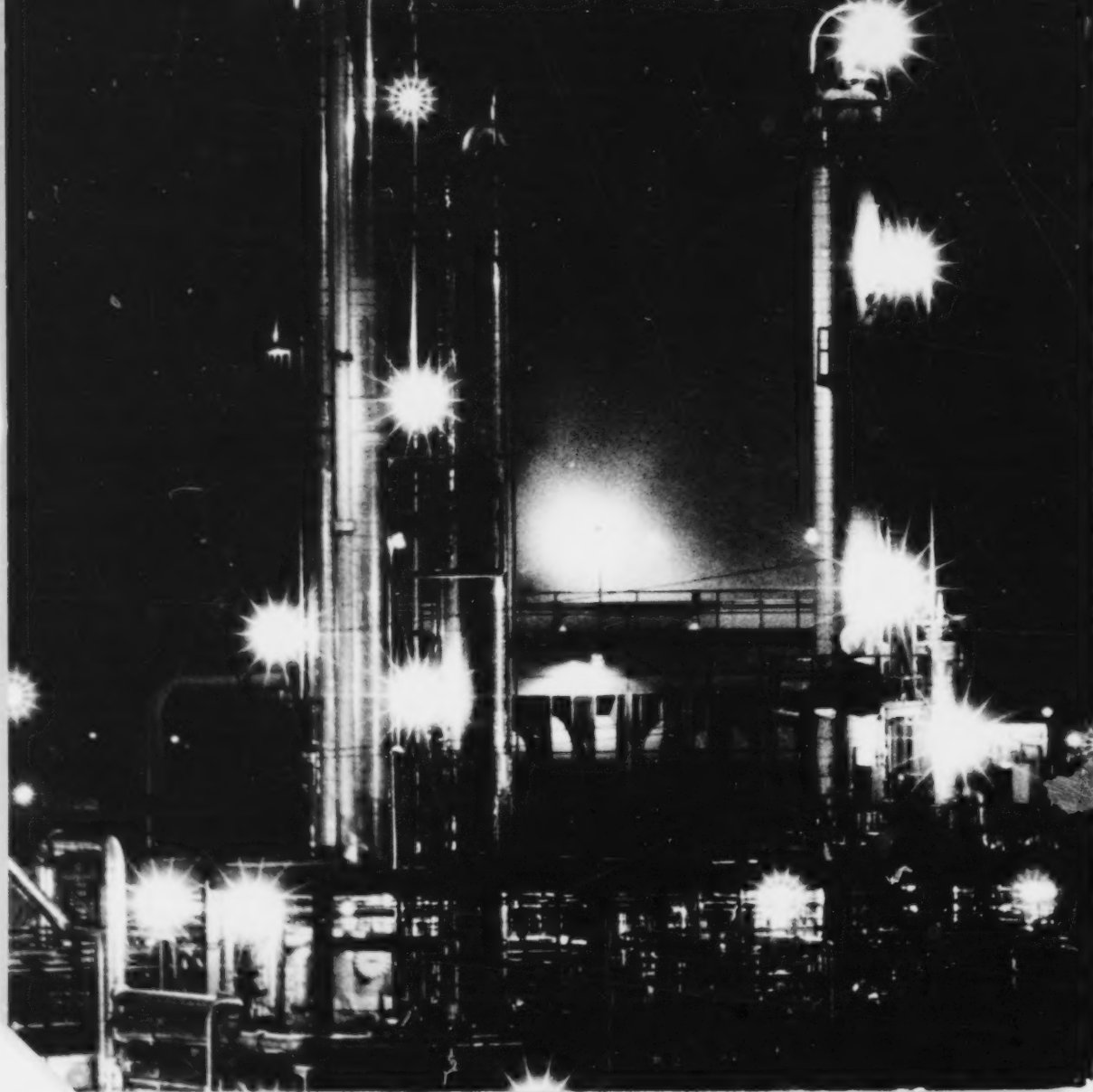
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June 1989

PB89-208144



The Toxics-Release Inventory

A National Perspective



THE 1987 TOXICS RELEASE INVENTORY: AN INTRODUCTION

The 1987 Toxics Release Inventory was mandated by the "Emergency Planning and Community Right-to-Know Act" enacted by Congress in October of 1986. The law, also known as Title III of the Superfund Amendments, is based on the premise that citizens have a "right-to-know" about toxic chemicals in their communities, and has two main purposes: to encourage planning for response to chemical accidents; and to provide the public and the government information about possible chemical hazards in their communities. The law requires States to establish State Emergency Response Commissions and Local Emergency Planning Committees to collect detailed information of local manufacturers.

The law further requires certain manufacturers to report to the U.S. Environmental Protection Agency (EPA) and to States the amounts of over 300 toxic chemicals that they release directly to air, water, or land, or that they transport to off-site facilities. In addition, the law specifies that the EPA must compile these reports into an annual inventory of releases and transfers—the Toxics Release Inventory (TRI)—and make the inventory available to the public in a computerized database. This report summarizes release and transfer data for 1987, the first year of data collection under TRI.

Who Must Report to TRI?

TRI requirements for 1987 covered all manufacturing facilities in the 50 states, the District of Columbia, Puerto Rico, American Samoa, the Northern Mariana Islands, and the U.S. Virgin Islands that met the following conditions:

- they produced, imported, or processed 75,000 or more pounds of any of the 328 TRI chemicals, or they used in any other manner 10,000 pounds or more of a TRI chemical;
- they were engaged in general manufacturing activities; and
- they employed the equivalent of ten or more employees full time.

Which Toxic Chemicals for 1987?

The 1987 TRI reporting requirements covered more than 300 toxic chemicals and 20 categories of chemical compounds. The TRI chemicals vary widely in toxicity and in the frequency, amounts, and industrial processes in which they are used.

What Constitutes a TRI Release?

TRI calls for facilities to report the amounts of the listed toxic chemicals that are **released** directly to air, water, or land. In addition, manufacturers must report amounts of chemicals that are transported (transferred) **off-site** to facilities, including public sewage systems, that treat or dispose of the chemical wastes. Both routine releases and accidental spills or leaks must be reported. Facilities must report even if their releases comply with all environmental laws and permits. TRI data is not necessarily an indication of regulatory violations.

What to Report?

EPA required that manufacturers submit a TRI data form (EPA Form R*) for *each* TRI chemical they manufactured or used in 1987. The information requested on the TRI form includes facility address and other identification, off-site locations to which TRI chemicals are transferred in wastes, and specific chemical information for releases, off-site transfers, and treatment.

* FOR A COPY OF FORM R AND INSTRUCTIONS FOR COMPLETING IT, CONTACT:
EPA DOCUMENT DISTRIBUTION CENTER, P.O. BOX 12505, CINCINNATI, OH 45212.

THE TOXICS RELEASE INVENTORY

A National Perspective, 1987

*A report on the first year of data collected under Section 313 of the
Emergency Planning and Community Right-to-Know Act of 1986.*

United States Environmental Protection Agency
Office of Toxic Substances
Economics and Technology Division
Washington, DC 20540
June, 1989

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- C. Industries Covered by TRI Reporting Requirements
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FOREWORD

The Emergency Planning and Community Right-to-Know Act of 1986 is fundamentally changing the relationship between EPA and the public. For the first time, a major EPA program has been launched with the goal of providing the public—rather than EPA—information about toxic chemicals. This information, of course, is proving enormously useful to EPA. But its primary purpose is captured by the title of the law—*Community Right-to-Know*.

One of the cornerstones of the law is the **Toxics Release Inventory (TRI)**, an annual compilation of information on the release of toxic chemicals by manufacturing facilities. This report summarizes the first year of TRI data, and analyzes where toxic chemicals are being released, along with the amounts and types of releases. Although the Community Right-to-Know Act does not require EPA to prepare a national report, I believe this is an important means of fulfilling the spirit of the law.

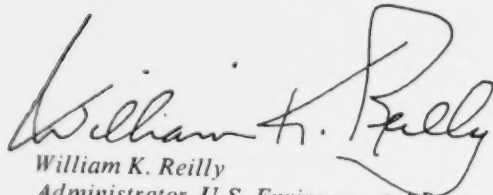
The information in this National Report will no doubt raise concern about toxic releases. This is exactly what it is meant to do. Informed about toxic chemicals, citizens can play an important role in helping their communities achieve tangible results in protecting public health and the environment.

EPA has always depended on public input to help shape environmental policy, and now that role has become even more important. The Right-to-Know law is empowering the public. Implicit in this power, I believe, is a responsibility-to-act. TRI is a tool—one tool—by which citizens can help improve their community's environment. Use the information to identify releases in your community. Involve your schools, local press, civic and business and conservation organizations. Express your concerns to facilities handling toxics, to industry trade groups, to local and state agencies, to your elected officials, and to us, at EPA.

The public also has a right to know what EPA is doing. Some of the problems highlighted by the TRI data have already been addressed since data were submitted in 1987. Many toxics once legally placed in landfills, for instance, are now banned. This change should be

reflected in next year's data. Other issues need attention. What and where are the most serious risks to public health and the environment? How many people are affected? How many and what kind of ecosystems? Is the Toxics Release Inventory collecting all the information it should? How can toxic air emissions be better controlled? Are there pollution reduction strategies that may be more effective?

The Toxics Release Inventory tells me that after nearly two decades of progress towards better air and water quality we still have a way to go. More technology, more controls are not enough. We need to begin now talking about preventing pollution at its source. I am excited about the potential of EPA's pollution prevention initiatives which aim to reduce toxic releases and other wastes significantly over time. As we progress, the Toxics Release Inventory will be an important means of documenting the nation's achievements in this area.

A handwritten signature in dark ink, reading "William K. Reilly". The signature is fluid and cursive, with a large, stylized "R" at the end.

William K. Reilly
Administrator, U.S. Environmental Protection Agency

PREFACE

Fifteen thousand people work for the Environmental Protection Agency, and at times it seemed all of them had a hand in shaping this report. And in truth, because so many aspects of EPA's activities are focused on the control of toxic chemicals, the preparation of this National Report would not have been possible without an integrated, cooperative effort amongst many of the Agency's program offices.

As is common with EPA reports, those involved in its preparation and review were asked to do enormous tasks under impossible deadlines. As is also common, they are far too numerous to be named here. Their work is recognized and greatly appreciated.

The Toxics Release Inventory Task Force, the National Report Review Team, and EPA's Regional Office representatives were all instrumental both in reviewing and in helping to coordinate review of the various draft stages of the National Report. They performed a vital and exemplary task.

Lastly, to all those whose vision created the Community Right-to-Know effort and the Act which bears its name, we hope you find this report a worthy testimony to your efforts.

DAVID SAROKIN
NATIONAL REPORT PROJECT MANAGER

The 1987 Toxics Release Inventory: A National Summary

Total Releases and Transfers of TRI Chemicals

In 1987, the first year of reporting under the Toxics Release Inventory (TRI), manufacturing facilities reported the release of 18.0 billion pounds¹ of TRI chemicals directly into the air, water, land or underground wells, and an additional 4.6 billion pounds of TRI chemicals transferred off-site to other facilities, such as public sewage systems or incinerators, for treatment or disposal. All told, TRI encompassed 22.5 billion pounds of releases and transfers in its first year of reporting (Figure 1-1). A total of 19,278 manufacturing facilities submitted 74,152 individual chemical reports, or an average of almost four TRI chemicals per facility.

Eighteen billion pounds of TRI chemicals were released to the environment in 1987 and 4.9 billion pounds were transferred off-site for treatment or disposal.

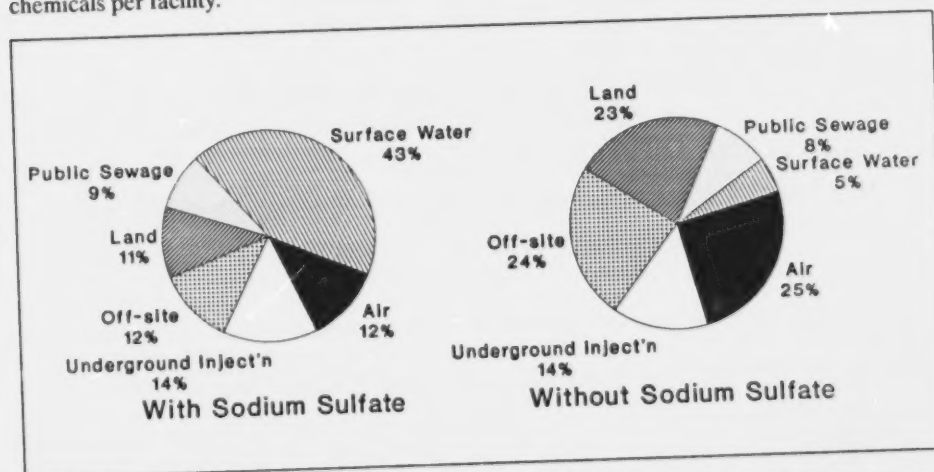


Figure 1-1.
Total TRI Releases and Transfers, 1987. Total with sodium sulfate: 22.5 billion pounds. Total without sodium sulfate: 10.4 billion pounds.

¹ This report is based on data retrieved from the March 15, 1989 version of EPA's TRI database. Numbers reported may differ slightly from those available now. Figures cited here and throughout the text of this report have been rounded off, so totals may not always be exactly the same. Refer to tables for exact data.

The 1987 Toxics Release Inventory

Sodium sulfate accounted for more than half of all TRI releases and transfers in 1987.

Over half of the TRI total consisted of a single chemical—sodium sulfate. Because it was reported in such large amounts, sodium sulfate affects the overall patterns of releases and transfers presented here, sometimes obscuring smaller releases of more toxic TRI chemicals. The influence of this one chemical, which may be removed from the TRI list, is discussed throughout this report (Box 1-B).

TRI release data reveal the amounts of TRI chemicals that are annually and routinely discharged into the environment (Box 1-A). These data do not, however, directly gauge the amounts of chemicals to which humans or the environment are *exposed*, nor do they measure the *risks* posed by TRI chemicals. Many factors combine to determine how much of a risk, if any, is imposed by particular releases and transfers of TRI chemicals (Box 1-C). Nor are the releases necessarily an indication of violations of environmental laws; many EPA and State programs permit some releases of toxic chemicals under controlled or properly managed conditions that prevent or minimize risks.

The following sections present selected highlights of TRI data on the nation-wide releases and transfers of TRI chemicals:

- how TRI chemicals were released to air, land, and water or transported off-site
- where TRI chemicals were released in 1987
- which industries played major roles
- which chemicals played major roles

TRI AT A GLANCE

What is TRI? A compilation of information reported to EPA on more than 300 chemicals used or released to the environment by manufacturers in 1987.

Who reports? Manufacturing facilities in the U.S. that manufactured, imported, or processed more than 75,000 pounds of the 328 TRI chemicals or used more than 10,000 pounds of TRI chemicals and that employed ten or more workers full time during 1987.

Where are TRI data kept? Manufacturers submitted TRI reports to the EPA and to state environmental agencies. The EPA maintains TRI data on a computerized database, available to the public through the National Library of Medicine's TOXNET computer network.

When was TRI compiled? Manufacturers were required to submit forms describing their 1987 releases by July 1, 1988. Reports will continue on an annual basis.

Limitations of TRI. Not all sources of toxic chemical wastes are included in TRI, and not all facilities which should have reported did so. The quality of the reported data must be viewed cautiously, since this is the first year of industry experience with TRI.

Box 1-A.

SODIUM SULFATE AND TRI

Sodium sulfate releases and transfers of more than 12 billion pounds dwarfed all other chemicals reported to TRI in 1987. Sodium sulfate alone accounted for 54 percent of total releases and transfers for all TRI chemicals. Moreover, a single facility in California released 5.2 billion pounds of sodium sulfate – 23 percent of total national TRI releases and transfers.

EPA has been petitioned to remove sodium sulfate from the list of TRI chemicals requiring reporting due to an apparent absence of significant toxicity concerns for this chemical, which is produced in large volumes not only as a commercial product, but also as a by-product of manufacturing processes involving acids and bases. If the petition is granted, the portrait of TRI releases and transfers will change dramatically.

For example, California, which in 1987 had the largest amount of TRI chemical wastes, would drop to ninth in the nation without sodium sulfate. Discharges to surface water, which ranked first with a lion's share of the sodium sulfate releases (75 percent of the total sodium sulfate releases for 1987) would drop to last place of all the types of releases and transfers (Figure 1-1). The acids/bases/salts class of chemicals, which accounts for 69 percent of total TRI releases and transfers, would drop to only 33 percent without the influence of sodium sulfate. Finally, the total amount of TRI releases and transfers would be cut by more than half.

Box 1-B.

The reader should note the limitations of TRI data: not all toxic chemicals are included under TRI, nor are all sources of toxic chemical releases to the environment.

Environmental Distribution of TRI Releases and Transfers

Larger amounts of TRI chemicals were discharged to surface water than were emitted to air, disposed of on land, or transported off-site in 1987 (Figure 1-1, above). Almost half the total amount of TRI releases and transfers (9.6 billion pounds) was discharged to surface water. Facilities disposed of an additional 3.2 billion pounds (14 percent of the TRI total) by injecting chemicals into underground wells. Air received the next highest sum, with emissions totalling 2.7 billion pounds (12 percent), and facilities disposed of 2.5 billion pounds (11 percent) on land. The distribution changes significantly if sodium sulfate is not added in: air emissions, off-site transfers, and land releases take the lead, with 25, 24, and 23 percent of the total, respectively, while discharges to surface water drop to 5 percent and transfers to public sewage treatment plants drop to 8 percent.

Forty-three percent of the total TRI releases and transfers was discharged to surface water, 14 percent was injected in underground wells, 12 percent emitted to air, 9 percent discharged to public sewage, and 12 percent transferred to off-site facilities.

In addition to environmental releases, manufacturers discharged 1.9 billion pounds of TRI chemicals (9 percent of the TRI total) to public sewage systems and transported 2.6 billion pounds (12 percent) to

TRI DATA, EXPOSURE, AND RISK

The 18.0 billion pounds of TRI releases and 4.6 billion pounds of transfers are not an indicator of human or environmental exposure to these chemicals. Several factors should be kept in mind when considering the impact of TRI releases and transfers.

First, environmental releases do not always result in exposure. Releases to landfills or to underground injection are intended to isolate these wastes, and result in zero or low exposure unless there is an unexpected failure of the disposal technique.

Even chemicals that are not isolated in this manner require careful interpretation. TRI reveals that 2.7 billion pounds of TRI chemicals were released directly to the air, and 9.6 billion pounds to surface water in 1987. These releases cannot be equated directly to exposure, since each chemical in each individual release circumstance undergoes different transformations after release. Dilution may render exposure concentrations so small as to be of no concern. Gaseous emissions may be chemically transformed to harmless byproducts, or acidic wastewater discharges may be effectively neutralized by the receiving body of water. On the other hand, some environmental transformations lead to byproducts of even *greater* concern than the original releases. Each release scenario has its own unique characteristics.

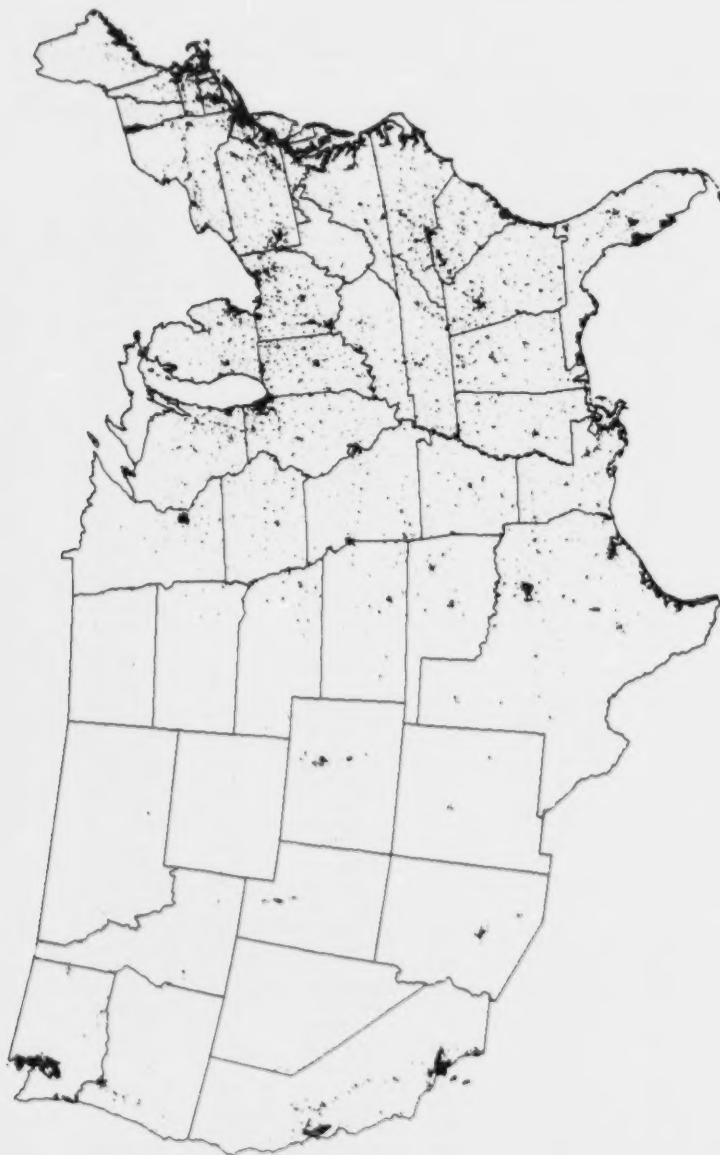
TRI chemicals were also transferred to sewage treatment plants and other off-site facilities, where they may undergo treatment (which can destroy or isolate a potentially toxic chemical) prior to ultimate disposal. The transfers also shift the location of materials, so that TRI releases generated in, say, New Jersey, may ultimately be sent to Ohio for treatment and/or disposal. A knowledge of the ultimate fate of these materials would be needed for any meaningful interpretation of potential risks.

Lastly, TRI chemicals cover a broad spectrum of toxicity concerns and total release or transfer amounts only give part of the story—a small release of a highly toxic chemical might be of much greater concern than a large release of a low-toxicity substance. In all cases, more information is needed to assess potential concerns than is provided by TRI data alone. TRI can only serve as an indicator to toxic chemicals that *may* be of concern, and hence require further attention and analysis.

Box 1-C.

off-site facilities for treatment or disposal. These facilities include private wastewater treatment plants, incinerators, and off-site landfills and underground injection wells.

Sodium sulfate played a singular role in the distribution of the TRI data, accounting for 95 percent of discharges to surface water, and more than 50 percent of discharges to underground injection and public sewage systems. Without sodium sulfate (which may be removed from the TRI list), these types of discharges would comprise a much smaller fraction of total TRI releases and transfers.



Map 1-1. Facilities Reporting to TRI Nationwide, 1987. Each dot represents one facility.

The 1987 Toxics Release Inventory

TABLE 1-1. NUMBER OF TRI FACILITIES AND AMOUNT OF RELEASES BY TYPE BY STATE, 1987
(Percentages are of total releases and transfers for the state)

STATE	TRI FACILITIES Number	TOTAL TRI AIR EMISSIONS		TOTAL TRI SURFACE WATER DISCHARGES		TOTAL TRI TRANSFERS TO PUBLIC SEWAGE	
		Pounds	Percent	Pounds	Percent	Pounds	Percent
Alabama	355	98,339,784	11.9	533,895,407	64.6	32,713,211	4.0
Alaska	7	31,707,083	85.8	5,221,865	14.1	35	0.0
American Samoa	2	56,250	78.1	15,750	21.9	0	0.0
Arizona	156	16,565,691	13.1	3,000	0.0	9,236,876	7.3
Arkansas	293	54,559,906	14.6	171,220,328	45.7	4,325,937	1.2
California	1,662	82,708,429	1.4	3,834,809,964	65.7	246,101,586	4.2
Colorado	172	11,010,395	31.2	3,325,009	9.4	3,125,396	8.8
Connecticut	383	26,078,031	30.2	25,225,312	29.2	9,544,587	11.1
Delaware	53	6,036,385	10.3	29,852,685	50.8	16,375,820	27.8
Florida	419	50,196,070	11.5	107,593,997	24.8	39,468,550	9.1
Georgia	636	93,586,285	14.1	473,506,462	71.6	47,093,822	7.1
Hawaii	33	1,064,495	21.0	2,542,000	50.2	973,250	19.2
Idaho	52	4,176,707	5.7	50,737,549	69.1	3,250,118	4.4
Illinois	1,185	99,226,761	21.2	33,437,606	7.1	199,165,360	42.5
Indiana	720	112,870,299	15.4	105,987,418	14.5	95,899,156	13.1
Iowa	310	39,238,921	54.8	15,335,547	21.4	10,090,895	14.1
Kansas	184	24,738,143	13.5	7,578,737	4.1	6,647,139	3.6
Kentucky	298	51,666,181	20.6	76,869,713	30.6	13,649,364	5.4
Louisiana	259	138,254,193	8.0	775,836,211	45.0	1,334,641	0.1
Maine	83	14,607,382	6.7	195,803,966	89.2	5,071,706	2.3
Maryland	191	20,234,753	10.4	111,795,540	57.3	47,863,355	24.5
Massachusetts	560	30,061,360	28.7	2,116,295	2.0	36,142,507	34.5
Michigan	758	116,359,932	15.7	38,127,898	5.1	38,245,470	5.1
Minnesota	301	42,095,160	29.7	15,826,354	11.2	70,020,634	49.5
Mississippi	247	57,285,976	8.7	473,882,098	72.2	9,125,709	1.4
Missouri	503	50,623,710	17.3	36,406,436	12.4	112,489,998	38.5
Montana	27	5,255,856	13.7	791,946	2.1	28,109	0.1
Nebraska	139	14,403,622	68.1	2,754,398	13.0	1,213,294	5.7
Nevada	33	742,389	6.3	0	0.0	33,814	0.3
New Hampshire	129	12,983,935	19.9	42,428,961	65.1	2,802,094	4.3
New Jersey	875	41,983,116	13.6	55,063,498	17.8	123,413,118	40.0
New Mexico	32	3,831,726	17.0	9,057	0.0	738,719	3.3
New York	765	89,399,757	27.4	56,110,261	17.2	65,294,934	20.0
North Carolina	820	94,568,576	21.4	217,090,591	49.2	54,537,779	12.4
North Dakota	28	935,275	33.4	393,600	14.0	94,217	3.4
Ohio	1,261	172,685,650	23.9	68,219,055	9.4	131,193,018	18.1
Oklahoma	193	36,445,117	28.1	65,792,624	50.7	1,692,971	1.3
Oregon	217	20,941,392	17.4	63,362,600	52.5	13,900,170	11.5
Pennsylvania	1,027	87,547,598	20.0	61,901,577	14.1	39,815,049	9.1
Puerto Rico	172	12,867,913	30.0	1,676,734	3.9	23,060,390	53.7
Rhode Island	166	5,927,841	22.3	13,187,892	49.5	2,998,055	11.3
South Carolina	394	64,215,277	12.4	340,939,102	65.8	51,090,961	9.9
South Dakota	37	2,441,359	69.4	3,698	0.1	620,208	17.6
Tennessee	503	135,010,665	22.4	196,399,204	32.6	97,149,025	16.1
Texas	999	238,817,765	8.5	659,657,602	23.6	154,293,072	5.5
Utah	102	77,327,036	31.0	133,749	0.1	2,032,004	0.8
Vermont	52	1,379,661	28.2	1,113,799	22.8	298,037	6.1
Virgin Islands	1	2,033,873	27.4	5,303,250	71.4	0	0.0
Virginia	399	132,436,076	29.8	225,383,321	50.8	55,690,097	12.5
Washington	308	40,637,496	10.0	303,684,767	74.6	4,061,980	1.0
West Virginia	107	35,564,455	20.9	87,295,714	51.2	5,179,381	3.0
Wisconsin	645	48,656,361	26.3	16,563,741	9.0	46,313,952	25.0
Wyoming	27	3,154,641	5.0	3,460,037	5.5	17,800	0.0
TOTAL	19,278	2,655,542,710	11.8	9,615,673,925	42.7	1,935,517,370	8.6

TABLE 1-1. (Continued)

STATE	TOTAL TRI ON-SITE LAND RELEASES		TOTAL TRI UNDERGROUND INJECTION		TOTAL TRI OFF-SITE TRANSFERS		TOTAL TRI RELEASES/ TRANSFERS	TOTAL TRI RELEASES/ TRANSFERS
	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Rank
Alabama	98,091,692	11.9	1,443,591	0.2	62,580,627	7.6	827,064,312	4
Alaska	14,930	0.0	0	0.0	139	0.0	36,944,052	42
American Samoa	0	0.0	0	0.0	0	0.0	72,000	53
Arizona	97,102,866	77.0	0	0.0	3,163,551	2.5	126,071,984	31
Arkansas	108,534,294	29.0	13,016,449	3.5	23,124,550	6.2	374,781,464	18
California	47,693,392	0.8	1,530,850,645	26.2	97,644,358	1.7	5,839,808,374	1
Colorado	12,547,494	35.5	1,170	0.0	5,321,533	15.1	35,330,997	43
Connecticut	1,848,676	2.1	0	0.0	23,677,774	27.4	86,374,380	34
Delaware	2,565,876	4.4	250	0.0	3,987,692	6.8	58,818,708	39
Florida	190,827,201	43.9	29,437,389	6.8	17,162,515	3.9	434,685,722	16
Georgia	14,969,473	2.3	19,500	0.0	32,555,326	4.9	661,730,868	8
Hawaii	237,342	4.7	216,140	4.3	30,226	0.6	5,063,453	49
Idaho	14,988,307	20.4	0	0.0	259,307	0.4	73,411,988	35
Illinois	11,209,153	2.4	14,221,970	3.0	111,556,134	23.8	468,816,984	12
Indiana	246,523,580	33.7	63,356,466	8.7	107,092,085	14.6	731,729,004	6
Iowa	768,722	1.1	0	0.0	6,149,084	8.6	71,583,169	36
Kansas	1,058,669	0.6	91,067,410	49.7	52,300,709	28.5	183,390,807	27
Kentucky	4,028,637	1.6	25,000,250	10.0	79,727,997	31.8	250,942,142	22
Louisiana	154,894,837	9.0	553,820,180	32.1	101,793,171	5.9	1,725,933,233	3
Maine	2,037,139	0.9	0	0.0	2,040,371	0.9	219,560,564	24
Maryland	4,318,725	2.2	750	0.0	11,035,136	5.7	195,248,259	25
Massachusetts	3,575,212	3.4	250	0.0	32,931,176	31.4	104,826,800	33
Michigan	3,979,327	0.5	6,472,752	0.9	539,530,650	72.6	742,716,029	5
Minnesota	1,722,105	1.2	250	0.0	11,833,822	8.4	141,498,325	29
Mississippi	15,252,731	2.3	46,433,140	7.1	54,106,141	8.2	656,085,795	9
Missouri	56,439,000	19.3	1,001,450	0.3	35,466,064	12.1	292,426,658	21
Montana	32,223,598	83.8	0	0.0	138,140	0.4	38,437,649	41
Nebraska	349,910	1.7	0	0.0	2,428,365	11.5	21,149,589	46
Nevada	10,817,492	92.2	0	0.0	141,555	1.2	11,735,250	47
New Hampshire	666,529	1.0	0	0.0	6,249,760	9.6	65,131,279	37
New Jersey	5,312,503	1.7	780	0.0	82,811,996	26.8	308,585,011	20
New Mexico	17,307,456	76.8	0	0.0	641,055	2.8	22,528,013	45
New York	17,598,716	5.4	500	0.0	97,670,612	30.0	326,074,780	19
North Carolina	30,157,949	6.8	250	0.0	44,990,734	10.2	441,345,879	14
North Dakota	1,100,500	39.3	0	0.0	279,990	10.0	2,803,582	52
Ohio	47,664,590	6.6	71,850,645	9.9	232,280,058	32.1	723,893,016	7
Oklahoma	2,482,881	1.9	7,171,133	5.5	16,196,697	12.5	129,781,423	30
Oregon	13,998,763	11.6	0	0.0	8,401,643	7.0	120,604,568	32
Pennsylvania	70,957,429	16.2	74,000	0.0	177,338,841	40.5	437,634,494	15
Puerto Rico	184,150	0.4	988	0.0	5,137,365	12.0	42,927,540	40
Rhode Island	69,009	0.3	0	0.0	4,439,825	16.7	26,622,622	44
South Carolina	8,994,959	1.7	750	0.0	52,886,551	10.2	518,127,600	11
South Dakota	9	0.0	0	0.0	452,952	12.9	3,518,226	51
Tennessee	20,550,544	3.4	124,406,900	20.7	28,631,687	4.8	602,148,025	10
Texas	835,087,965	29.8	630,223,666	22.5	281,688,463	10.1	2,799,768,533	2
Utah	185,467,430	66.3	3	0.0	4,782,932	1.9	249,743,154	23
Vermont	168,696	3.5	0	0.0	1,929,473	39.5	4,889,666	50
Virgin Islands	87,505	1.2	0	0.0	0	0.0	7,424,628	48
Virginia	6,949,712	1.6	250	0.0	23,590,468	5.3	444,049,924	13
Washington	25,105,014	6.2	500	0.0	33,588,830	8.3	407,078,587	17
West Virginia	11,638,215	6.8	1,719,219	1.0	29,174,069	17.1	170,571,053	28
Wisconsin	7,535,521	4.1	1,500	0.0	65,886,063	35.6	184,957,138	26
Wyoming	24,183,539	38.6	30,651,671	49.0	1,129,103	1.8	62,596,791	38
TOTAL	2,451,889,964	10.9	3,242,462,757	14.4	2,617,957,365	11.6	22,519,044,091	

A total of 19,278 facilities reported to TRI. More facilities reported from California than from any other state.

TRI Facilities

A total of 19,278 manufacturing facilities reported to TRI from all 50 states, Puerto Rico, the U.S. Virgin Islands, and American Samoa (Map 1-1). No facilities reported from the District of Columbia or from the Commonwealth of the Northern Mariana Islands.

More than half of the manufacturers were located in ten states. California had the largest number of TRI facilities—1,662 facilities. Each of the top ten states had more than 700 facilities reporting, for a total of 10,072 facilities (Table 1-1).

Geographical Distribution of TRI Releases and Transfers

California, Texas, and Louisiana had the largest total TRI releases and transfers.

The 5.8 billion pounds of releases and off-site transfers from California dwarfed those of any other state, accounting for 26 percent of the TRI total for the nation (Map 1-2). However, a disproportionately large amount of California's total was due to sodium sulfate releases from a single facility in the state which discharged 3.7 billion pounds of this chemical to surface water, and an additional 1.5 billion pounds by underground injection. (Indeed, this single facility was responsible

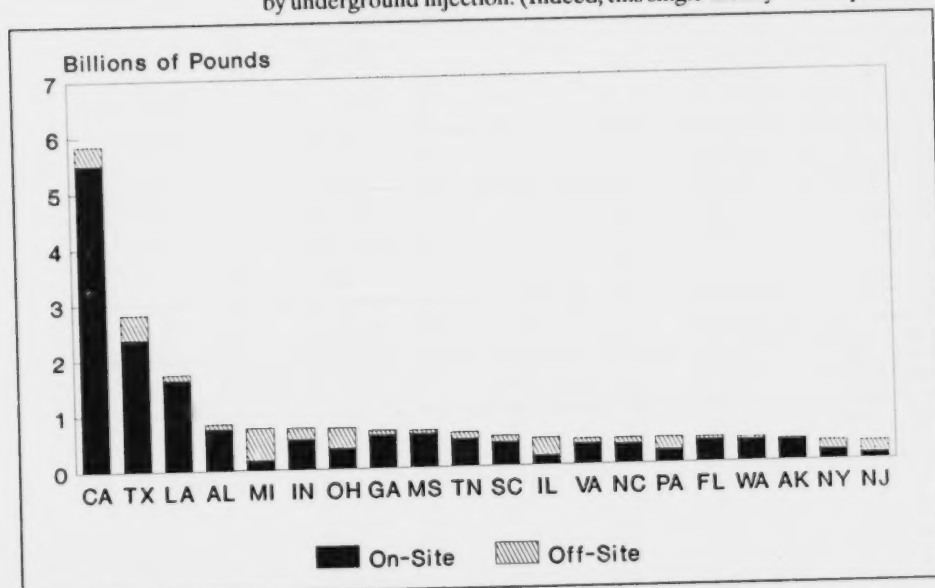
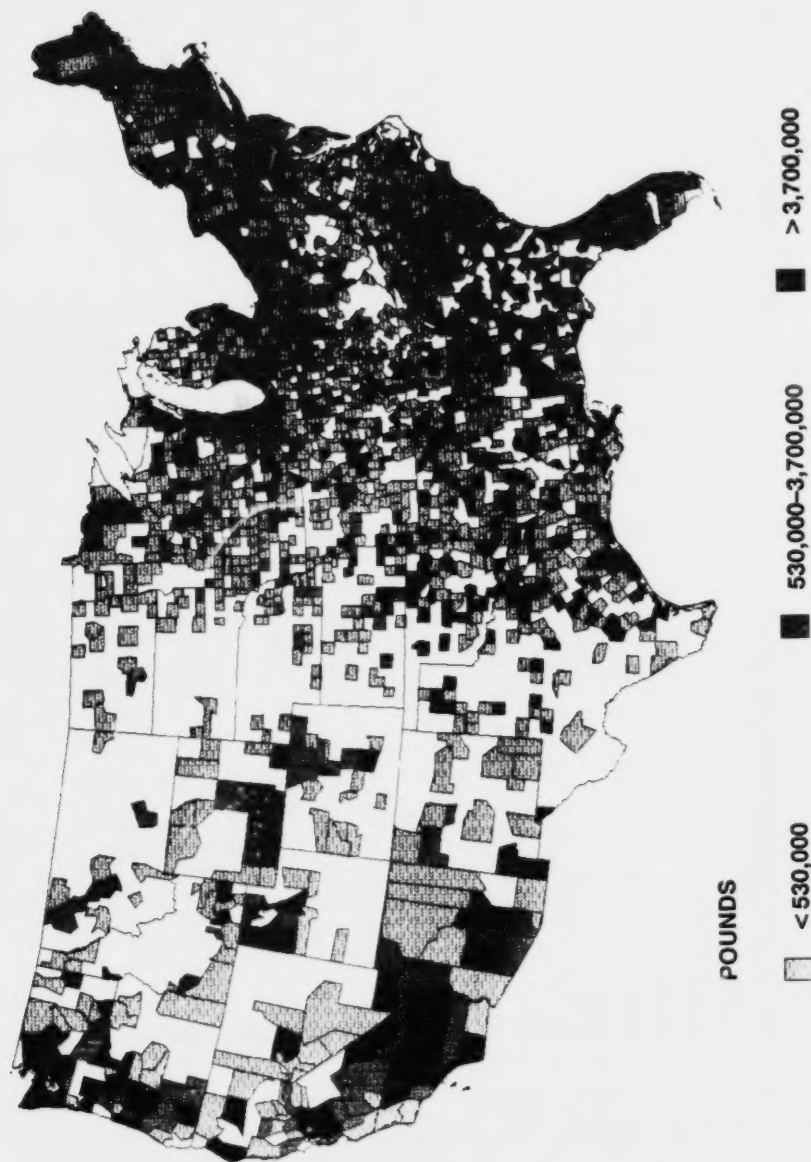


Figure 1-2.
The 20 States with the Largest Total Releases and Transfers, 1987.



Map 1-2. TRT Total Releases and Transfers Nationwide, by County, 1987

The 1987 Toxics Release Inventory

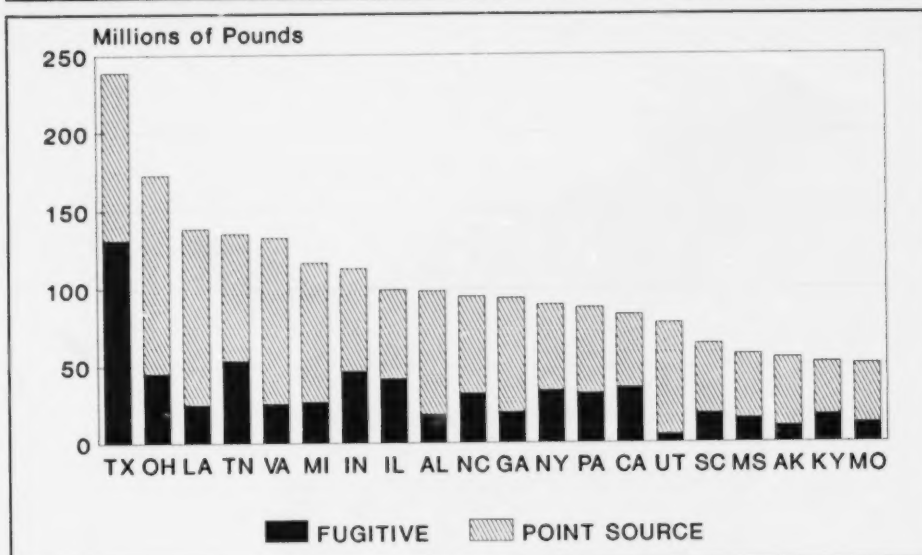


Figure 1-3.
The 20 States with the Largest Total Air Emissions of TRI Chemicals, 1987.

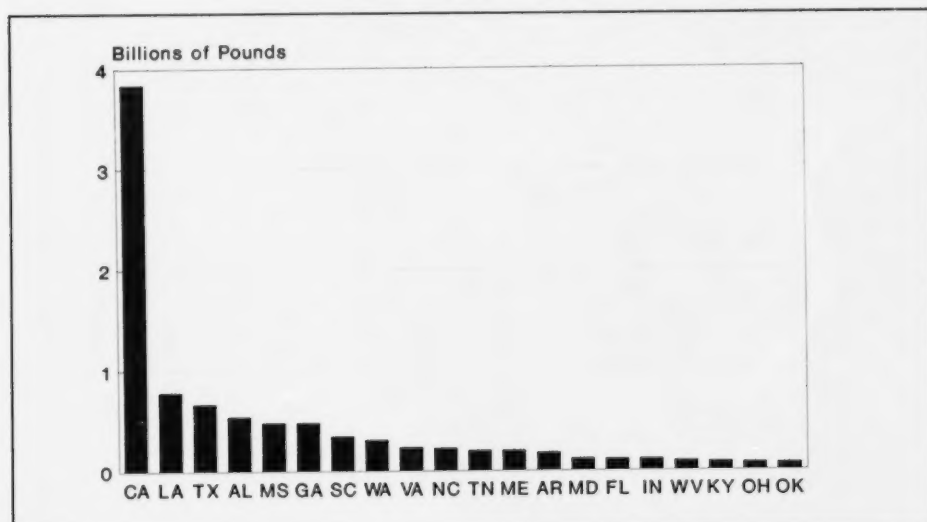


Figure 1-4.
The 20 States with the Largest Surface Water Discharges of TRI Chemicals, 1987.

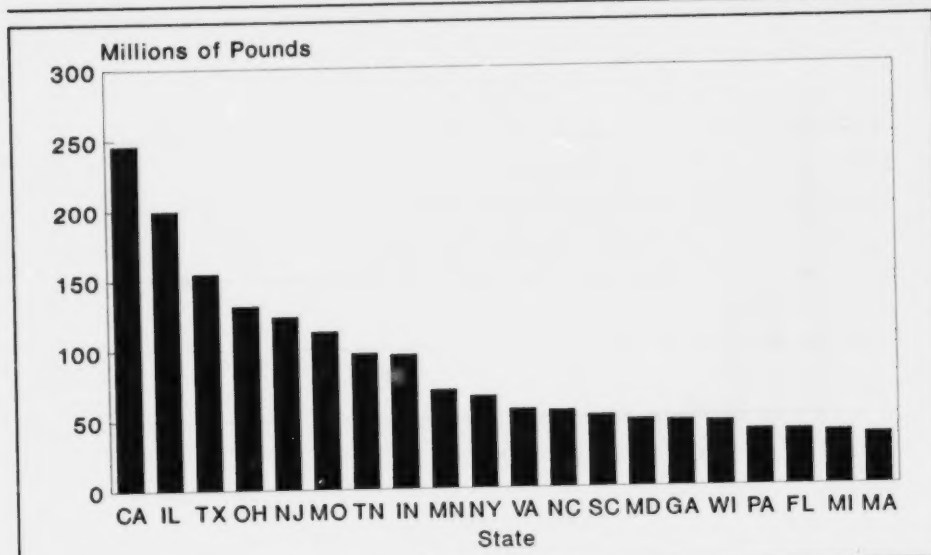


Figure 1-5.
The 20 States with the Largest Discharges of TRI Chemicals to Public Sewage Systems, 1987.

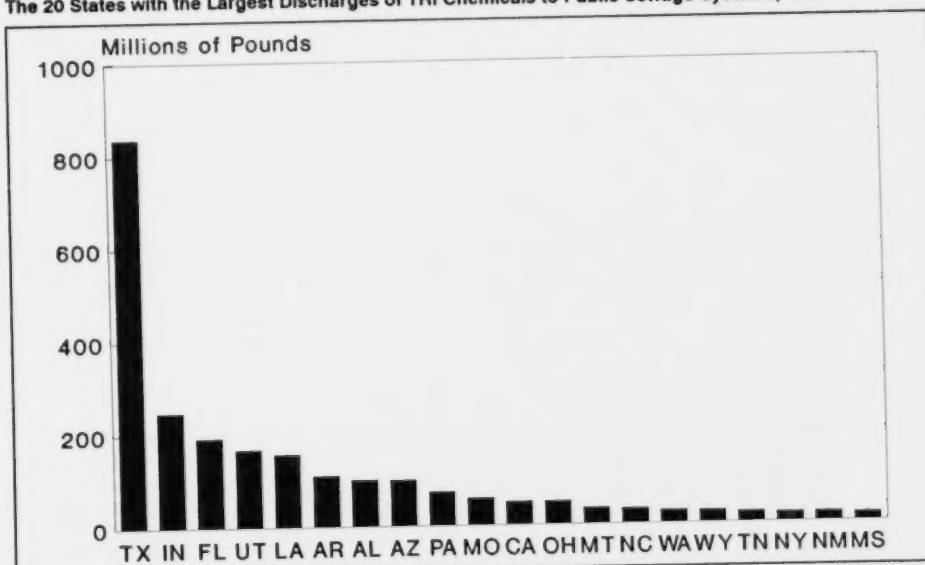


Figure 1-6.
The 20 States with the Largest On-Site Land Disposal of TRI Chemicals, 1987.

The 1987 Toxics Release Inventory

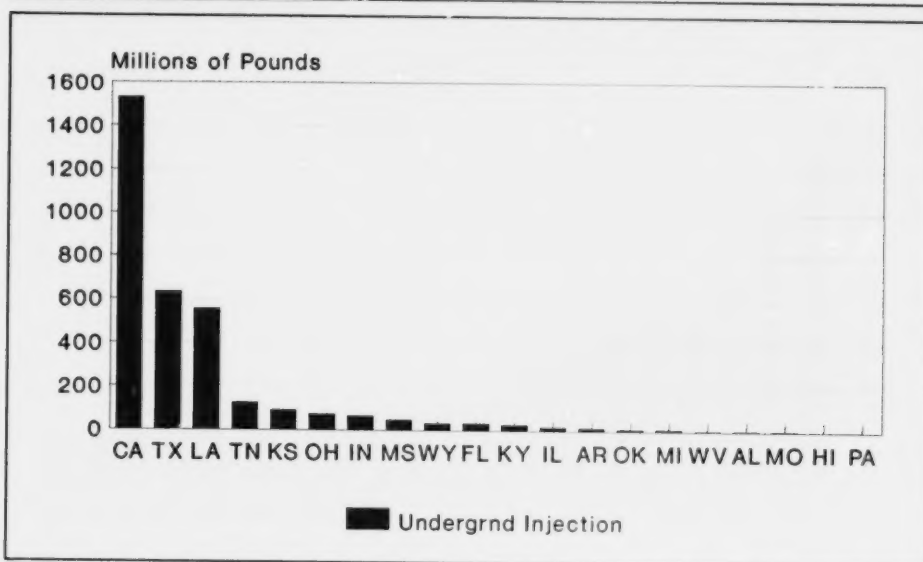


Figure 1-7.
The 20 States with the Largest Underground Injections of TRI Chemicals, 1987.

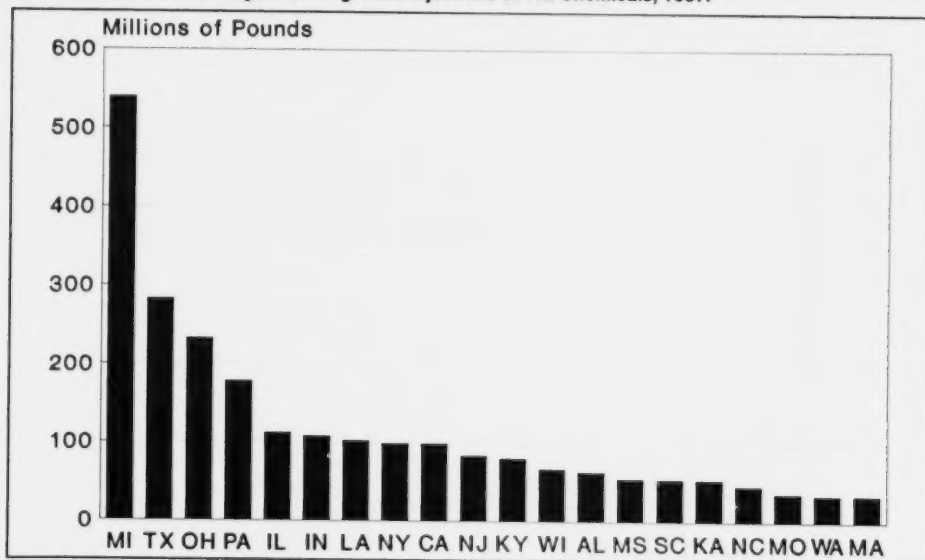


Figure 1-8.
The 20 States with the Largest Total Off-Site Transfers of TRI Chemicals, 1987. (By state from which off-site transfers originated.)

for nearly 45 percent of the nation's total sodium sulfate releases and transfers.)

Texas and Louisiana ranked second and third for total TRI releases and transfers, with 2.8 and 1.7 billion pounds, respectively (Figure 1-2). Sodium sulfate did not account for a particularly large share of the totals for either state.

Rankings amongst the states changed somewhat according to the type of release or transfer (Figures 1-3, 1-4, 1-5, 1-6, 1-7, and 1-8). However, Texas, Louisiana, and California were generally among the top five states for nearly every type of release or transfer. Two notable exceptions were that California ranked only 14th for total air emissions, and Louisiana was ranked 41st for discharges to public sewage systems.

Michigan facilities transported by far the largest share of TRI chemicals to off-site facilities, accounting for over one fifth of the total amount of wastes transported (Figure 1-8, above). Over half of the state's total was composed of aluminum oxide transported off-site by a single facility.

Distribution of TRI Releases and Transfers in States

States differ markedly in the environmental distribution of their TRI releases and transfers (Table 1-1, above). In California, surface water discharges and underground injection dominated, together accounting for 93 percent of the state's total. In Maine, surface water discharges alone accounted for nearly 90 percent of that state's TRI total. In Western states such as Nevada, New Mexico, and Utah, the largest share of TRI chemicals was disposed of on land (92 percent, 77 percent, and 66 percent of the state total, respectively).

Michigan facilities transferred 73 percent of their TRI total off-site; Pennsylvania and Vermont followed with 41 percent and 39 percent, respectively. On the other hand, only two percent of California's TRI total, and six percent of Louisiana's were transferred to off-site facilities, the remainder being on-site releases.

Industrial Patterns of Releases and Transfers

The Chemical industry generated 54 percent of the total TRI releases and transfers.

The Chemical industry discharged 48 percent of its total TRI releases and transfers to surface water.

The Chemical and Allied Products industry produced more TRI releases and transfers than any other industry in 1987, with a total of 12.1 billion pounds or 54 percent of the TRI total for all industries (Table 1-2, Figure 1-9). Chemical manufacturers produced more releases and transfers than any other industry in each of the following categories: air emissions, discharges to surface water, underground injection, and transfers to public sewage systems. Two other industries reported TRI totals of more than one billion pounds: Paper Products and Primary Metals. Together, these three industries generated 78 percent of all releases and transfers reported under TRI.

Industries generated distinct patterns of TRI releases and transfers. Almost half of the Chemical industry's total was releases to surface water; releases to underground injection comprised an additional 24 percent. Surface water discharges also accounted for a large fraction (78 percent) of the Paper industry's total releases and transfers. The Primary Metals industry released 1.4 billion pounds of chemicals to land and transferred 961 million pounds off-site, accounting for 76 percent of this industry's releases and transfers. The Transportation Equipment industry, although accounting for only 1.5 percent of the

TABLE 1-2. AMOUNT OF TRI RELEASES AND TRANSFERS BY TYPE BY INDUSTRY, 1987

SIC CODE	INDUSTRY	TRI FACILITIES Number	TOTAL AIR RELEASES		SURFACE WATER		TRANSFERS TO PUBLIC SEWAGE	
			Pounds	Percent	Pounds	Percent	Pounds	Percent
20	Food Products	1,576	17,337,833	6.04	30,560,639	10.65	205,826,534	71.71
21	Tobacco Manufacturers	24	7,566,510	72.32	132,545	1.27	2,293,820	21.93
22	Textile Mill Products	469	36,305,895	10.95	182,363,632	52.12	119,540,333	34.16
23	Apparel	37	2,295,032	48.11	42,810	0.90	2,336,808	48.99
24	Lumber and Wood Products	644	26,879,647	74.75	1,001,064	2.78	1,545,461	4.30
25	Furniture and Fixtures	332	50,928,135	85.26	47,984	0.08	853,889	1.43
26	Paper Products	663	232,639,586	8.29	2,183,493,703	77.78	184,880,068	6.59
27	Printing, Publishing	287	54,122,107	85.99	3,521	0.01	3,444,032	5.47
28	Chemical Products	3,849	946,395,722	7.83	5,835,403,944	48.27	784,202,550	6.49
29	Petroleum Refining	343	79,137,824	10.38	366,051,900	48.02	50,530,645	6.63
30	Rubber and Plastic Products	1,125	143,760,863	51.88	54,077,618	19.52	48,224,867	17.40
31	Leather Products	117	14,098,158	27.07	1,959,658	3.76	31,984,904	61.41
32	Stone, Clay, Glass Products	629	27,035,373	23.11	1,322,017	1.13	7,146,933	6.11
33	Primary Metals	1,305	234,283,732	9.03	105,944,217	4.09	180,432,302	6.96
34	Fabricated Metals	2,393	109,921,878	35.89	9,079,259	2.96	76,585,656	25.00
35	Machinery, except Electrical	787	49,698,725	50.15	4,439,271	4.48	10,528,548	10.63
36	Electric and Electronic Equip.	1,426	110,349,790	37.14	13,080,342	4.40	85,642,196	28.82
37	Transportation Equipment	908	213,563,972	64.25	3,878,314	1.17	18,199,214	5.48
38	Measuring, Photographic Goods	306	46,331,167	57.10	3,153,101	3.89	9,766,977	12.04
39	Misc. Manufacturing	337	24,865,197	68.45	264,802	0.73	2,103,483	5.79
	Multiple SIC codes in 20 - 39	1,317	211,289,810	12.36	799,136,129	46.73	100,432,157	5.87
	No SIC codes in 20 - 39	404	14,735,754	9.96	20,237,455	13.68	9,015,992	6.09
	GRAND TOTAL	19,278	2,655,542,710	11.79	9,615,673,925	42.70	1,935,517,370	8.60

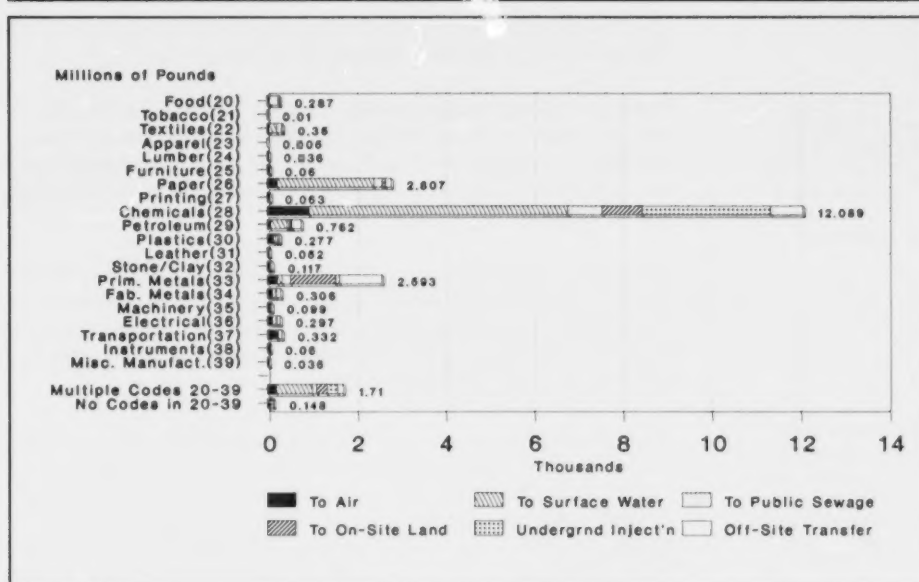


Figure 1-9.
Distribution of TRI Total Releases and Transfers by Industry, 1987. Industries are grouped according to Standard Industrial Classification (SIC) Codes.

TABLE 1-2 (Continued)

INDUSTRY	TOTAL ON-SITE LAND		UNDERGROUND INJECTION		TRANSFERS OFF-SITE		TOTAL TRI RELEASES/ TRANSFERS Pounds	TOTAL RELEASES/ TRANSFER RANK
	Pounds	Percent	Pounds	Percent	Pounds	Percent		
Food Products	23,018,190	8.02	190,586	0.07	10,077,922	3.51	287,011,684	10
Tobacco Manufacturers	10,810	0.10	0	0.00	458,196	4.38	10,461,861	21
Textile Mill Products	642,327	0.18	0	0.00	9,058,955	2.59	349,911,142	6
Apparel	1,500	0.03	0	0.00	94,221	1.09	4,770,371	22
Lumber and Wood Products	2,625,119	7.30	0	0.00	3,909,453	10.87	35,980,744	20
Furniture and Fixtures	28,105	0.05	0	0.00	7,857,362	13.16	59,715,475	17
Paper Products	77,350,923	2.76	30,894	0.00	129,014,310	4.60	2,807,409,484	2
Printing, Publishing	2,597	0.00	0	0.00	5,364,131	8.52	62,936,388	16
Chemical Products	900,323,396	7.45	2,902,166,936	24.01	720,337,123	5.96	12,088,829,671	1
Petroleum Refining	39,701,782	5.21	21,174,667	2.78	205,764,651	26.99	762,361,489	5
Rubber and Plastic Products	806,162	0.29	49,800	0.02	30,177,303	10.89	277,096,613	11
Leather Products	166,320	0.32	0	0.00	3,878,288	7.45	52,087,326	18
Stone, Clay, Glass Products	25,056,647	21.42	6,326,300	5.41	50,081,467	42.82	116,966,737	13
Primary Metals	1,021,550,898	39.39	90,418,540	3.49	960,608,352	37.04	2,593,238,041	3
Fabricated Metals	4,970,842	1.62	1,453,671	0.47	104,277,700	34.05	306,289,006	8
Machinery, except Electrical	660,719	0.67	0	0.00	33,764,108	34.07	99,091,372	14
Electric and Electronic Equip.	7,315,930	2.46	2,437,306	0.82	78,291,668	26.35	297,117,232	9
Transportation Equipment	5,397,988	1.62	47,339	0.01	91,310,180	27.47	332,397,007	7
Measuring, Photographic Good	164,116	0.20	0	0.00	21,725,976	26.78	81,141,337	15
Misc. Manufacturing	248,233	0.68	250	0.00	8,842,508	24.34	36,324,473	19
Multiple SIC codes in 20 - 39	249,504,529	14.59	217,854,136	12.74	131,767,953	7.71	1,709,964,714	4
No SIC codes in 20 - 39	92,342,831	62.42	312,352	0.21	11,295,538	7.64	147,939,922	12
GRAND TOTAL	2,451,889,964	10.89	3,242,462,757	14.40	2,617,957,365	11.63	22,519,044,091	

Over half of the total TRI releases and transfers was generated by facilities that engaged only in manufacturing chemicals.

The Chemical industry accounted for 41 percent of all TRI discharges to public sewage treatment plants.

TRI total, had disproportionately large air emissions and contributed 8 percent of total TRI air emissions for all industries.

Facilities reporting *manufacturing* as their sole activity for TRI chemicals (as opposed to *processing*, or *other uses* such as equipment cleaning) comprised only 1.3 percent of TRI facilities nationwide, but accounted for 12 billion pounds of releases and transfers – 56 percent of the TRI total.

Industries also differed in their patterns of on-site releases/off-site transfers. The Primary Metals industry transferred 37 percent of its TRI total off-site; the Chemical industry only six percent. Together, these two industries accounted for 64 percent of total off-site transfers for all industries reporting under TRI.

The Chemical industry accounted for 41 percent (784 million pounds) of all TRI chemicals discharged to public sewage treatment plants. Facilities in each of four additional industries discharged more than 100 million pounds of TRI chemicals to public sewage systems: Food and Kindred Products with 11 percent (206 million pounds); Paper Products with ten percent (185 million pounds); Primary Metals with nine percent (180 million pounds); and Textiles with six percent (120 million pounds). Discharges to public sewage systems from these five industries made up 76 percent of the total.

The Primary Metals industry transported 961 million pounds of TRI chemicals to off-site facilities, which accounted for the largest share (37 percent) of off-site transfers. The Chemical industry ranked second for off-site transfers, transporting 720 million pounds, or 28 percent of the total.

Off-site Transfers: The Interstate Transport of TRI Wastes

While transfers to public sewage systems are generally local, other off-site transfers to treatment and disposal facilities may cross state lines. In 1987, over one quarter of all reported off-site transfers (731 million pounds) were transported to facilities across state lines (Figure 1-10). Ohio facilities received 13 percent of all out-of-state transfers (92 million pounds), the largest share for any state.² Louisiana, Indiana, New Jersey, Pennsylvania, and Michigan also received large amounts of off-site transfers from out-of-state facilities, each accepting over 40 million pounds of off-site transfers.

One quarter of all reported off-site transfers were transported to off-site facilities across states lines.

Facilities were not required to report transfers of TRI chemicals sent off-site for recycling. Some facilities appear to have reported such data, however, and these are included in the off-site transfer totals.

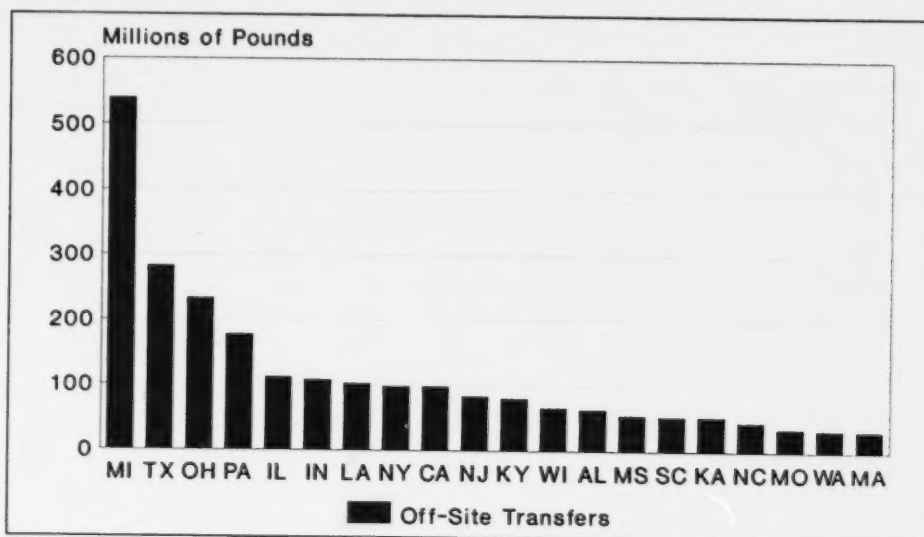


Figure 1-10. Transfers of TRI Chemicals Across State Lines, 1987. Amounts listed for states receiving transfers from out-of-state.

² Transfer locations were not identified for 102 million pounds (four percent) of the chemical wastes transferred off-site, so it cannot be determined what fraction, if any, of this amount was transported to out-of-state locations.

Chemicals with the Largest Releases and Transfers

Twenty-five chemicals accounted for 94 percent of the total TRI releases and transfers in 1987.

The 25 chemicals with the largest TRI totals accounted for 94 percent of all releases and transfers (Table 1-3). As mentioned earlier, 12.1 billion pounds of sodium sulfate dominated TRI totals, accounting for 54 percent of all releases and transfers. Aluminum oxide was the only other chemical with a TRI total of greater than one billion pounds, accounting for 20 percent of the TRI releases and transfers. Both chemicals are under review by EPA and may be removed from the TRI list of reportable chemicals due to a lack of significant toxicity concerns.

TABLE 1-3. THE 25 TRI CHEMICALS WITH THE LARGEST TOTAL RELEASES AND TRANSFERS BY MEDIA, 1987

Rank	CHEMICAL NAME	TOTAL DISCHARGES		TOTAL TRANSFERS TO PUBLIC	TOTAL ON-SITE RELEASES TO LAND	TOTAL UNDERGROUND INJECTION	TOTAL OFF-SITE TRANSFERS	TOTAL RELEASES/ TRANSFERS	Percent
		TOTAL AIR EMISSIONS Pounds	SURFACE WATERS Pounds						
1	SODIUM SULFATE (SOLUTION)	0	9,061,039,211	1,052,044,568	91,199,023	1,736,973,179	130,808,774	12,079,585,192	53.64
2	ALUMINUM OXIDE	63,845,554	36,101,026	2,976,516	1,363,735,259	56,724,250	861,591,039	2,434,973,644	10.81
3	AMMONIUM SULFATE (SOLUTION)	6,381,186	90,169,835	189,392,111	7,249,407	611,231,000	13,419,977	917,843,516	4.08
4	HYDROCHLORIC ACID	52,512,848	13,674,538	57,802,155	12,114,031	413,453,666	107,387,120	656,744,356	2.92
5	SULFURIC ACID	19,406,368	77,533,817	100,123,426	79,173,009	135,999,729	230,515,099	642,751,448	2.85
6	SODIUM HYDROXIDE (SOLUTION)	7,880,603	78,730,126	239,348,220	131,481,032	34,336,640	135,071,693	626,849,514	2.78
7	AMMONIA	318,028,225	31,641,355	36,650,299	4,967,305	47,783,620	5,413,883	444,484,887	1.97
8	METHANOL	196,038,365	24,909,084	92,511,680	14,702,670	19,582,087	71,802,772	419,546,588	1.86
9	TOLUENE	258,279,298	339,959	3,418,364	1,747,264	1,520,943	79,259,364	344,565,192	1.53
10	PHOSPHORIC ACID	1,615,570	128,632,077	15,425,906	187,196,718	73,704	10,776,338	343,922,311	1.53
11	ACETONE	178,348,341	2,032,678	14,057,015	256,979	2,280,943	37,814,073	234,592,029	1.04
12	XYLENE (MIXED ISOMERS)	137,243,778	473,529	4,102,755	844,953	596,751	74,812,447	217,664,213	0.97
13	METHYL ETHYL KETONE	145,610,523	75,691	612,678	66,763	75,250	46,085,612	192,748,517	0.86
14	1,1,1-TRICHLOROETHANE	151,233,854	40,700	416,380	199,061	28,325	29,998,240	181,916,590	0.81
15	COPPER	2,370,791	276,053	537,980	138,313,940	452,890	35,928,437	177,678,091	0.79
16	ZINC COMPOUNDS	5,753,287	1,630,598	1,734,423	106,238,413	707,696	60,512,500	176,576,897	0.78
17	DICHLOROMETHANE	118,439,343	369,150	1,627,208	67,621	580,000	31,225,718	152,289,040	0.68
18	CARBON DISULFIDE	136,167,630	22,791	180,511	3,480	89,500	251,400	136,715,512	0.61
19	CHLORINE	110,349,352	10,975,651	8,952,662	1,529,801	84,439	1,743,642	131,235,577	0.58
20	AMMONIUM NITRATE (SOLUTION)	7,545,171	11,716,298	9,804,636	15,076,212	58,585,000	12,140,708	114,848,028	0.51
21	MANGANESE COMPOUNDS	2,043,072	689,597	596,083	33,932,183	10,800,800	66,662,040	114,738,785	0.51
22	NITRIC ACID	7,204,493	16,642,456	30,900,534	8,914,511	9,187,612	25,287,175	96,136,781	0.44
23	ZINC (FUME OR DUST)	4,270,474	454,434	1,777,237	44,081,364	189,574	40,574,726	91,347,806	0.41
24	ETHYLENE	60,792,720	12,698	250	7,436	0	8,858,936	69,472,028	0.31
25	FREON 113	53,105,656	36,587	105,101	22,562	817	9,090,984	62,381,207	0.28
SUBTOTAL		2,064,666,702	9,568,399,925	1,862,504,751	2,272,944,935	3,143,288,394	2,126,260,597	21,063,787,712	93.54
TOTAL FOR ALL OTHERS		590,676,008	27,274,000	73,012,619	178,945,029	96,174,373	491,696,766	1,455,276,376	6.46
GRAND TOTAL		2,655,342,710	9,615,673,925	1,935,517,370	2,451,889,964	3,242,462,757	2,617,957,365	22,519,044,091	100.00

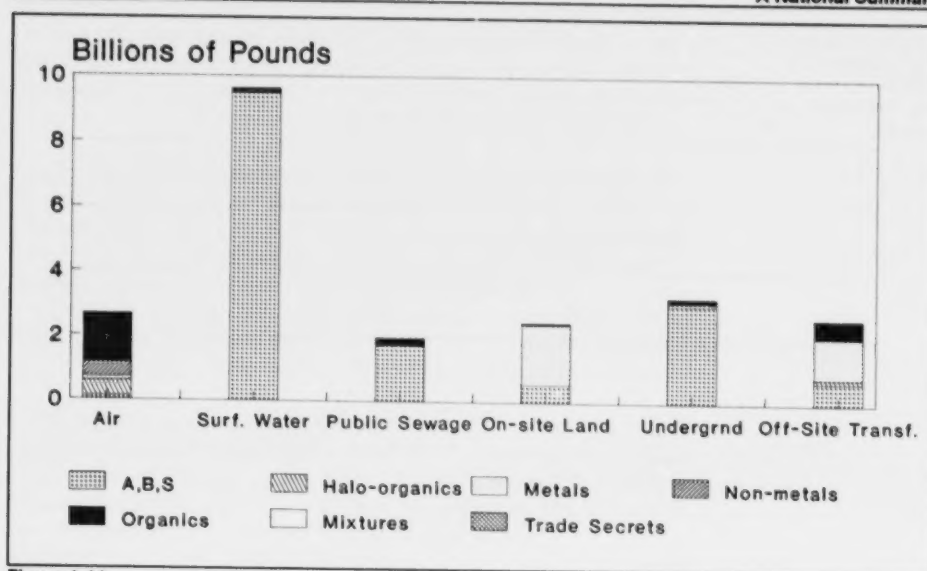


Figure 1-11.
TRI Releases and Transfers by Chemical Class, 1987.

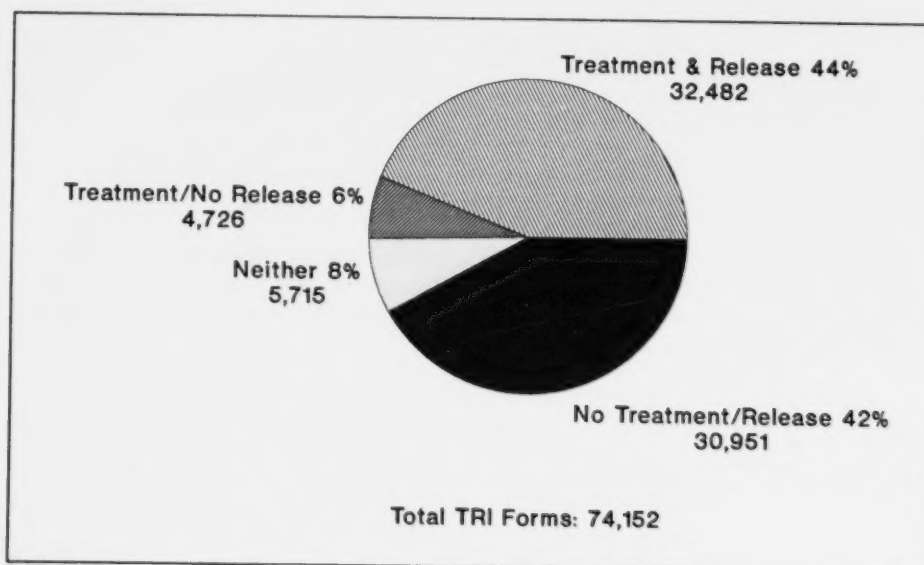


Figure 1-12.
TRI Forms Reporting Waste Treatment and Releases to the Environment, 1987.

The 1987 Toxics Release Inventory

Six chemicals had total releases and transfers greater than 500 million pounds.

Four additional chemicals had TRI totals greater than 500 million pounds: ammonium sulfate, hydrochloric acid, sulfuric acid, and sodium hydroxide. No TRI chemicals beyond the top 25 accounted for even 0.3 percent of the TRI total.

TRI chemicals played distinctly different roles in each type of release or transfer. Aluminum oxide accounted for the largest proportion of on-site land disposal (55 percent) and off-site transfers (33 percent). Sodium sulfate, not surprisingly, dominated releases in several categories: surface water discharges (94 percent), discharges to public sewage systems (54 percent), and underground injection (54 percent). Toluene, acetone and trichloroethane each accounted for more than 10 percent of total air emissions of TRI chemicals.

Grouping the 328 TRI chemicals and chemical categories into five classes—**acids/bases/salts**, **organics** (non-halogenated), **halogenated organics**, **metals and metal compounds**, and **non-metallic inorganics**—shows how releases and transfers vary among chemicals (Figure 1-11). Discharges to surface water are dominated by the acids/bases/salts class, while metals are a large portion of the TRI on-site land releases. Air emissions and off-site transfers are more evenly divided among these classes.

Waste Treatment

Half of all TRI facilities reported treating their chemical wastes.

Just over one half (9,725) of the TRI facilities indicated treating chemical wastes on-site before releasing or transferring them off-site. Six percent of all TRI forms reported treating wastes but not releasing them, which suggests that waste treatment for these chemicals was 100 percent successful (Figure 1-12).

On-site waste treatment was reported for 262 (96 percent) of the 272 chemicals and chemical categories for which TRI forms were received. No facilities reported on-site treatment for 12 of the chemicals.

The percentage of facilities reporting on-site waste treatment for individual chemicals varied. For example, 79 percent of the facilities that reported for nitric acid indicated that they treated wastes containing this chemical. However, only 25 percent of the facilities reporting 1,1,1-trichloroethane releases or transfers indicated on-site treatment of wastes containing it.

Waste Minimization

Eleven percent of TRI facilities (2,090 out of 19,278) reported attempts to minimize TRI chemical wastes in the *optional* waste minimization section on the TRI form. These facilities submitted six percent of the total TRI forms for 1987. A subset³ of 802 facilities was examined to detail waste minimization between 1986 and 1987. The subset reported generating 121 million pounds of waste in 1986 and only 69 million pounds in 1987, for an overall reduction of 52.4 million pounds (43 percent.) Factoring in the impact of changes in production levels, overall reductions appear even larger – more than 60 percent. Facilities in Michigan, Texas, and Louisiana reported the most waste minimization (11.5, 8.9 and 4.5 million pounds respectively). **On-site recycle/reuse** achieved the largest reductions of waste (21.1 million pounds), for an overall 50 percent reduction. **Self-initiated reviews** were cited most often as the reason for pursuing waste minimization; **regulatory requirements** were cited infrequently (Figure 1-13).

Eleven percent of TRI facilities reported attempts to minimize TRI chemical wastes.

On-site recycling/reuse resulted in the largest amount of waste minimization.

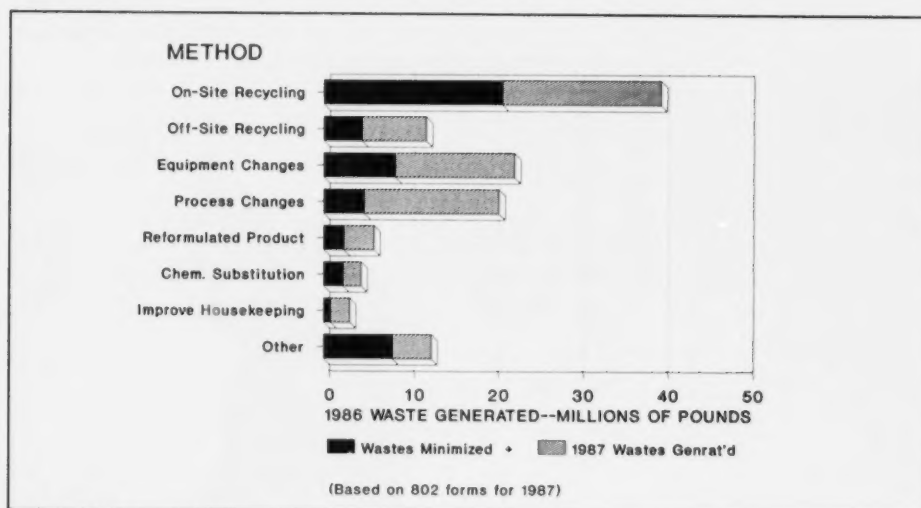


Figure 1-13.
Amount of TRI Waste Minimization by Method, 1987.

³ A subset was necessary for two reasons: (1) because the section was optional, the amount of information provided about waste minimization varied; and (2) many forms appeared to contain errors that were sorted out of the data for the sake of accuracy. Because the waste minimization data was optional, neither the full set of data nor the subset are representative of the nation as a whole.

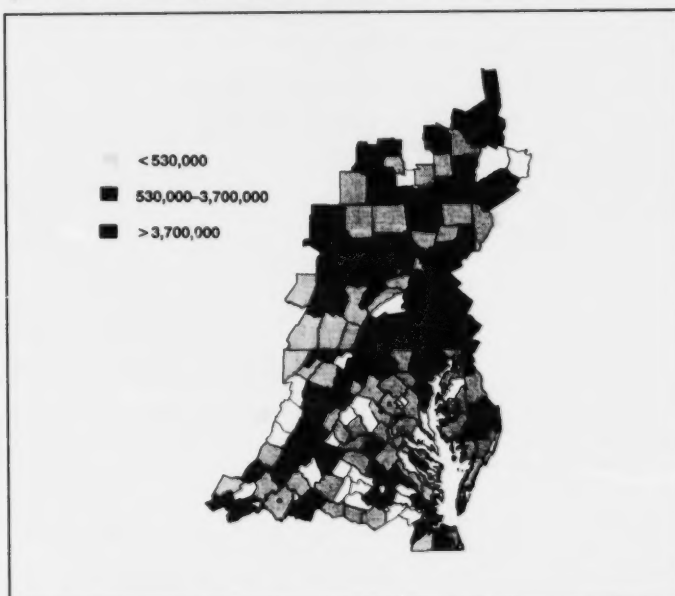
Other Analyses

This report focusses on the broad national perspectives available from 1987 Toxics Release Inventory (TRI) data. TRI data can, however, be analyzed at other levels. National analyses could be narrowed to provide greater detail about particular topics, or about regional, state, or local conditions. The two examples provided below—regional analyses of water systems and exports of chemical wastes—suggest some of the other analyses for which TRI data can be used.

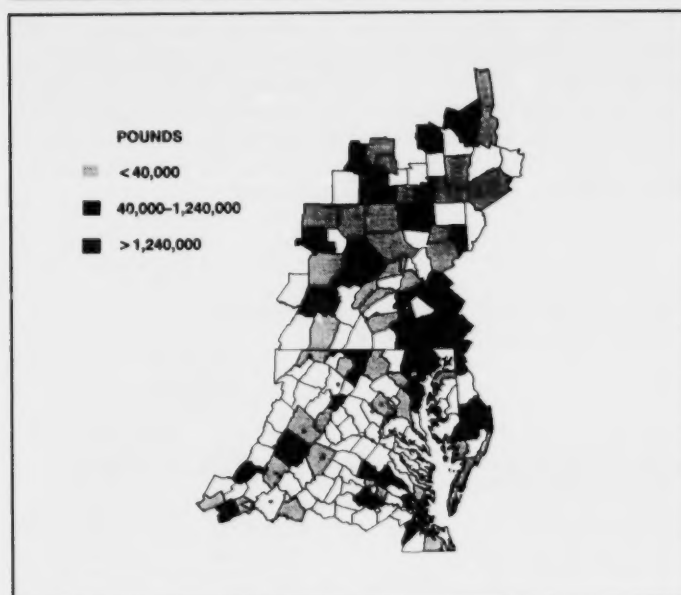
Regional Analyses: Major Water Systems

Geographical analyses could focus on releases near major water systems to examine the chemicals that might eventually end up in the water. For example, six states lie in the Chesapeake Bay's drainage basin; TRI chemicals released in any of those six could potentially affect the Bay or the ecosystems it supports. TRI data can be used to locate all TRI facilities within this region by latitude and longitude and to display their releases and transfers (Map 1-3). As illustrated, the heaviest concentrations of TRI releases and transfers are in the area just north of the Bay and in another area to the southwest.

Geographical analyses could focus on releases in the drainage basins of major waterways.



Map 1-3.
Total TRI Releases and Transfers in the Chesapeake Bay Area, 1987.



Map 1-4.

TRI Discharges to Surface Water in the Chesapeake Bay Area, 1987.

While all releases and transfers of TRI chemicals might affect the Bay region, direct discharges to surface waters may pose a more immediate concern. TRI data can be used to map all discharges of TRI chemicals to surface waters (Map 1-4) that were reported for 1987 in order to investigate the situation in more detail. Such analyses could be further refined to examine discharges of a particular chemical or set of chemicals.

TRI Chemical Exports

An analysis of TRI chemical wastes exported to other countries yields an international perspective of the manufacture and disposal of TRI chemicals. The export of TRI chemical wastes from the United States can be examined by searching the TRI data for off-site transfer locations outside the United States.

U.S. facilities exported six million pounds of toxic chemical wastes to 13 sites outside the country.

For 1987, TRI facilities identified 13 different sites outside of the country to which U.S. facilities transferred six million pounds of chemical wastes (Table 1-4).⁴ Canadian sites received the largest amounts of TRI chemical wastes. The remainder of the exported TRI chemical wastes were transferred to sites in Europe (in Belgium, Spain, and the United Kingdom). Some of the international transfers were recycled, rather than treated or released.

TABLE 1-4. TOTAL TRI RELEASES AND TRANSFERS FOR THE CHEMICAL AND ALLIED PRODUCTS INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL TRI RELEASES/ TRANSFERS	
		Pounds	Cumulative Percent
28-	Chemicals & Allied Products - General	17,175,923	0.14
281	Industrial Inorganic Chemicals	1,722,789,318	14.25
282	Plastics & Synthetic Organics	533,077,745	4.41
283	Pharmaceutical & Biological Products	563,751,841	4.66
284	Soaps, Cleansers, Cosmetics	20,246,433	0.17
285	Paints	70,359,051	0.58
286	Industrial Organic Chemicals	938,658,593	7.76
287	Pesticides & Agricultural Chemicals	453,220,589	3.75
289	Printing Inks, Explosives & Other	5,317,647,271	43.99
	Multiple SIC codes within SIC 28	2,451,902,907	20.28
TOTAL RELEASES AND TRANSFERS		12,088,829,671	100.00

⁴ Transfer locations were not identified for 101 million pounds (four percent) of all off-site transfers, so it cannot be determined what fraction, if any, of this amount was transported to locations outside the U.S.

Chapter 2. Introduction to the Toxics Release Inventory

The Emergency Planning and Community Right-to-Know Act, enacted by Congress in 1986, created several new tools for both government and the general public to better manage the potential threats posed by industrial toxic chemicals. One of the key reporting requirements of the law was the creation of an annual inventory to document the types and amounts of toxic chemical wastes at manufacturing facilities. The inventory is known as the Toxics Release Inventory (TRI). It requires manufacturers that meet certain requirements (described below) to report to EPA and to States on over 300 toxic chemicals, including the quantity of chemicals released to the environment or sent off-site to waste treatment or disposal facilities. Of the four major reporting requirements of the law, TRI is the only one sent to EPA.

This report summarizes TRI data for 1987—the first year for which EPA has collected the data.¹ The main emphasis of the report is on environmental releases of TRI chemicals to the air, water, and land, and on transfers of these chemicals to off-site facilities for subsequent treatment or disposal. The information is organized to highlight geographic, industrial, and chemical patterns of releases and transfers. Because this report is the first in-depth look at the first year of TRI data, it also serves as something of a guide to what TRI is, and how it can be put to use.

Although this report focuses exclusively on TRI, it is important to realize that TRI is only one of a number of mechanisms created by the law to foster community right-to-know and planning for response to chemical emergencies. The law directs States to appoint State Emergency Response Commissions and Local Emergency Planning Committees at the community level. These mechanisms allow for consideration of risk and emergency planning for response to chemical accidents, through various reporting requirements of local

¹ The data contained in this report were retrieved from the March 15, 1989 version of EPA's TRIS database. The numbers presented herein may differ slightly from those available in the present versions of the database and from those reported in the Agency's April press release that described TRI data.

TRI: A Unique Tool

A number of TRI's features make it distinct from EPA's past data collection efforts on toxic chemicals.

MULTIMEDIA: TRI collects data on releases to all environmental media—air, water, and land—in contrast to most previous data collection efforts which focused on a single segment of the environment.

CHEMICAL SPECIFIC: TRI collects data on more than 300 chemicals and 20 chemical categories. In sharp contrast, many other data sets contain information on aggregated waste streams, where specific chemical identities can be obscured. Categories of data such as "still bottoms," "waste acids," or "volatile organics" are generic descriptions that provide useful information to EPA's control programs, but do not detail the actual toxic chemicals contained in industrial wastes.

DATABASE DESIGN: TRI is the first major environmental program intended from the outset to serve as an easily and publicly accessible data source on toxic chemical releases and transfers. For this reason, TRI is likely to find widespread and timely use as a major source of new data on toxic chemicals.

Box 2-A.

facilities about the presence of, accidental release of, storage of, and routine annual emissions of hazardous and toxic chemicals. The availability of all this information further allows consideration of and management of risk from such chemicals at the local level.

Also, TRI data are not EPA's only source of information on toxic chemicals. EPA has been collecting information on toxics since the Agency's inception to identify and respond to toxic chemical problems and to document the effectiveness of control programs. However, TRI does have several features which distinguish it from data collection efforts of the past and make it a unique and valuable source of information (see Box 2-A).

TRI Chemicals

TRI requires reporting on 308 individual chemicals and 20 chemical categories. A complete list of these chemicals and categories is contained in Appendix B.

The set of chemicals identified for reporting under TRI was drawn from lists developed independently by the states of Maryland and New Jersey for their own reporting purposes. The chemicals vary widely in toxicity, so large reported releases of chemicals of relatively low

toxicity may be of less environmental concern than smaller releases of highly toxic chemicals. Moreover, the list of chemicals currently covered does not include all toxic chemicals of concern being released by facilities into our environment. EPA has an on-going process to review the TRI list of chemicals and add new chemicals of concern, or delete chemicals that are no longer of concern.

The chemicals listed under TRI vary widely in their properties and uses. The list runs from familiar chemicals, such as ammonia, benzene and copper, to more obscure chemicals, such as 4-dimethylamino-azobenzene. TRI chemicals are manufactured not only as products, but are also incorporated into a wide variety of other products such as solvents, disinfectants, dyes, and catalysts, to name a few.

The chemicals also cover a gamut of toxicity, ranging from acutely lethal chemicals to those that are not very toxic and are therefore subject to removal from the TRI list as a part of EPA's ongoing review process (see Chapter 4, Box 4-A). A few chemicals, such as copper, are even essential to life in small quantities, even though they can be toxic in larger amounts. Throughout this report, readers should bear in mind the highly variable nature of TRI chemicals, and the fact that large amounts of TRI releases do not necessarily translate to a large potential for toxic effects.

While TRI lists 308 specific chemicals, it also incorporates 20 broadly-defined chemical *categories*, which can include many individual chemicals. Many of these categories are based on heavy metals — lead compounds, mercury compounds, and others. Any compound containing lead or mercury is subject to reporting if it meets the other TRI requirements described below.

TRI Releases and Transfers

TRI requires reporting of the amounts of toxic chemicals released directly to the environment or transferred to off-site locations. Releases and transfers include:

- emissions of gases or particles to the air
- wastewater discharges into rivers, streams or other bodies of water
- disposal of solid wastes in on-site landfills
- injection of liquid wastes into underground wells
- transfers of wastewater to public sewage treatment plants
- transfers of wastes to off-site facilities for treatment, storage or disposal

All releases and transfers, whether the result of routine waste generation or accidental spills, are included in TRI annual reporting.

Facilities That Must Report to TRI

Facilities were required to report TRI data for 1987 if they met a combination of criteria concerning the size and type of facility and the amount and nature of their use of TRI-listed chemicals. Facilities had to report if they met all three of the following criteria:

- they are a manufacturing facility
- they employ ten or more people
- they manufacture, import, or process more than 75,000 pounds or otherwise use more than 10,000 pounds of TRI chemicals

Other Information in TRI

TRI information is reported on a five-page form, a sample of which is reproduced in Appendix A. Facilities submit one complete form for each TRI chemical at the facility that meets reporting requirements; in other words, a facility that must report on five TRI chemicals must submit five separate reports. The basic information required by the form falls into six categories.

- **Facility Information.** In addition to facility name and address, TRI requires reporting of the following: a technical and public contact person, geographical data (latitude, longitude and county name), and various business and regulatory identifying numbers. Information on the facility's parent company is also required.
- **Off-Site Transfer Information.** The names, addresses and other identifying information for all sites to which the reporting facility transports TRI chemical wastes.
- **Chemical Use Information.** The identity of the TRI chemical being reported, along with information on the uses of the chemical at the facility and the maximum quantity present on-site during the reporting year.
- **Chemical Releases and Transfers.** Quantities of TRI chemicals released to air, water, or land and quantities transferred to off-site facilities.
- **Waste Treatment.** TRI also calls for data on the types of on-site methods used to treat TRI chemicals and the efficiency of these methods.
- **Waste Minimization.** TRI forms include an *optional* section allowing facilities to report activities that reduced their waste generation and the effect these activities had on their TRI releases and transfers.

Getting Access To TRI Data

The *TRI Reporting Center* is the national repository for all TRI reports submitted to EPA. The Center can accommodate limited requests for information on individual facilities. TRI reports filed for 1987 are available from the Center and from the National Library of Medicine database described below. Reports for 1988 will be available shortly after their July 1, 1989 due date. For specific requests, write the name and address of the facility of interest and send it to:

EPA TRI Reporting Center
470-490 L'Enfant Plaza
Suite 7103
Washington, D.C. 20022

Individual states can also provide copies of or access to TRI forms. Appendix D contains a list of state offices that can be contacted for forms or further information.

TRI data are computer accessible through the National Library of Medicine's *TOXNET* database. Detailed information on using TOXNET is contained in Appendix E.

TRI data are also available in the following formats: magnetic tape, microcomputer floppy disk for individual state data, microfiche for both state data and the national inventory, and CD-ROM (laser compact disk) for the national inventory. These versions of TRI data can be purchased from:

The National Technical Information Service (NTIS)
5284 Port Royal Road
Springfield, VA 22161
(703) 487-4650

OR

U.S. Government Printing Office (GPO)
U.S. Department of Commerce
Main Bookstore
710 N. Capitol Street, NW
Washington, D.C. 20401
(202) 275-2091

One or more of these versions of TRI data are available to the public at Federal depository libraries around the country. Your local library can help you locate the nearest federal depository library.

TRI-related documents available from EPA are listed in Appendix F.

Box 2-B

These are the types of data required to be reported to EPA under TRI, which form the basis for all the summary and overview information presented in this report.

TRI and Community Right-to-Know

The primary intent of TRI is to provide the public with information on potentially toxic chemicals. This report is one vehicle by which TRI data are being made available. Several other means of information-access are also in place (Box 2-B).

The National Library of Medicine's TOXNET System

The National Library of Medicine (NLM) has worked with EPA to establish a publicly-accessible computer database of TRI information. The TRI data are part of NLM's TOXNET system, which is designed to be readily accessible and easy to use. Users with a personal computer or a terminal and conventional communications software can call into the NLM system to obtain TRI data, which can be requested by many different variables including individual or groups of facilities, counties, states or chemicals.

The TRI Reporting Center and State Data Bases

TRI forms are due to EPA by July 1st of each year; the first year's reports for 1987 were due July 1, 1988. The forms are received and processed at the TRI Reporting Center in Washington, D.C. The Reporting Center can respond to limited requests for information. The Center is not intended to do the sophisticated data analyses that are possible through the NLM computer, but it can provide TRI data on individual facilities.

TRI facilities must also submit forms to their state. A number of state government agencies (listed in Appendix D) can also provide access to TRI data through paper copies or the state's computerized database.

Limits on Toxic Release Inventory Reporting

Subsequent chapters of this report attest that TRI provides important insights into industrial sources of environmental releases of chemicals. Like any information system, however, TRI has limitations that must be accounted for in any responsible use of the data. Major limitations include the chemicals and facilities covered, the protections for trade secrets, and the quality of the data estimated and reported.

TRI Coverage of Toxic Chemical Releases and Transfers

Toxic chemical wastes are generated from many different sources, including manufacturing and non-manufacturing industrial processes, use and disposal of consumer products, agricultural uses of chemicals, and mobile sources such as automobiles. TRI reporting requirements cover only manufacturing industries, which are not the source of all toxic releases. Other businesses, such as warehouses, photographic processing plants, dry cleaners, and mining operations, may be substantial sources of chemical releases and transfers, but are not included under TRI reporting requirements.

Furthermore, not all manufacturing releases of TRI chemicals are covered by the reporting requirements. Facilities with fewer than 10 full-time employees, and those producing, importing, processing, or using the designated chemicals below threshold amounts are not required to report. It is not possible to evaluate what fraction of facilities or environmental releases are exempt from reporting.

The release of a TRI toxic chemical does not necessarily indicate a violation of federal, state, or local environmental laws, nor does this report attempt to describe TRI releases within the context of such laws and regulations.

Trade Secrets

TRI allows companies to claim the chemical identity on TRI forms as trade secret if they can justify the need in advance. In these cases, facilities are required to report all TRI information under a generic chemical name. As of this writing, 40 trade secret claims are contained in the TRI database.

Data Quality

TRI only requires facilities to report data that are already known or reasonably ascertainable to them. It does not require companies to measure or otherwise verify the data they submit. Thus, much of the quantitative data reported were estimated with unknown accuracy. In addition, some reporting facilities misunderstood the intent of the form or made mistakes in reporting. Because this is the first year of reporting under TRI, it is reasonable to suppose that the quality of the reported data will improve in subsequent years as facilities gain more experience.

Failure to Comply with TRI Requirements

Although most facilities obeyed the law, an undetermined number of facilities did not comply with TRI reporting requirements. Some of these facilities completely failed to report, while others submitted incomplete reports.

EPA has begun an aggressive inspection program to identify the non-complying facilities and bring them into compliance. Facilities that fail to comply with the TRI reporting requirements may be prosecuted by EPA and assessed civil penalties of up to \$25,000 per day for each violation. The penalty can be much higher if a facility failed to report several TRI chemicals, because failure to report each single chemical is counted as a separate violation.

Some of the facilities subject to TRI are small- or middle-sized operations that were not previously regulated under federal environmental laws. EPA has conducted an active effort to inform these facilities of their obligations under TRI. This compliance promotion effort and the vigorous enforcement program will reduce the number of noncomplying facilities in future reporting years.

TRI Data and Risk

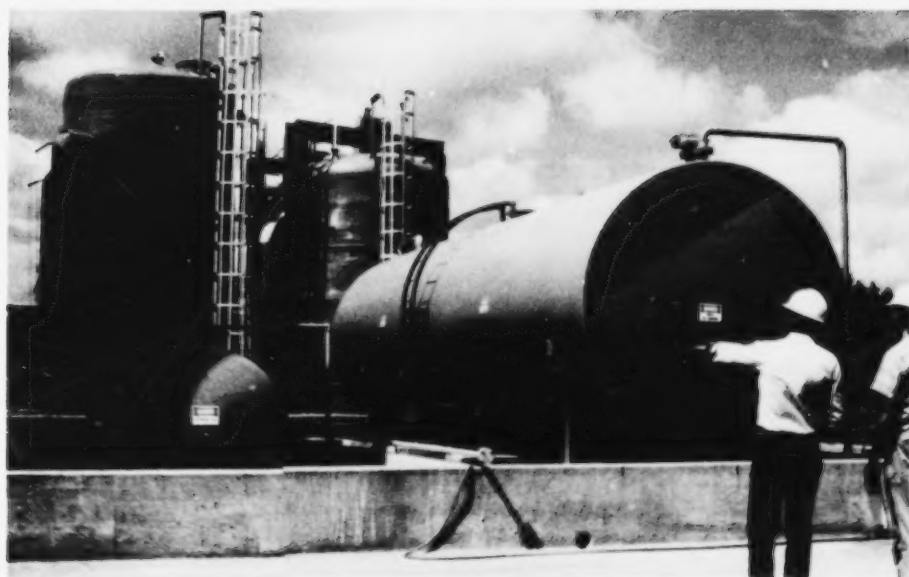
This report contains aggregated information on releases of toxic chemicals to the environment and transfer of these chemicals to off-site locations. This information does not, in and of itself, provide a meaningful index of the risk these chemicals may pose to health or the environment. As mentioned above, small releases of highly toxic chemicals may pose greater risks than very large releases of less toxic materials. A determination of risk depends on the individual release conditions: type and frequency of release, extent of exposure, environmental conditions, and so on. TRI data are best used as an indicator of where more detailed assessments of risk might be called for. (This topic is discussed more fully in Chapter 5).

READERS' COMMENTS

EPA is interested readers' comments on the utility and value of this report. We welcome recommendations of other topics that should be included in a national report, if a similar report is prepared in conjunction with future years of TRI reporting. Please send your comments and suggestions in writing to:

The Emergency Planning and Community Right-to-Know
Information Hotline
U.S. Environmental Protection Agency
OS-120
401 M Street, S.W.
Washington, D.C. 20460

ATTENTION: NR COMMENTS



Chapter 3. TRI Facilities

Introduction

More than 19,000 facilities filed Toxic Release Inventory (TRI) reports for 1987. The law requires manufacturing facilities to file TRI forms if they had 10 or more employees and if they manufactured, processed, or used toxic chemicals on the TRI list at minimum threshold amounts. (See Chapter 2 for details.) Facilities reported to the EPA from 50 states, Puerto Rico, the U.S. Virgin Islands and American Samoa. The District of Columbia and the Commonwealth of the Northern Mariana Islands were the only jurisdictions covered by the law with no reporting facilities.

More than 19,000 facilities reported to TRI for 1987.

In Part I of the TRI form, facilities provided general identifying information: facility name, contact person, address, industry type, and various identification numbers issued under environmental regulations or for business purposes (Figure 3-1). This chapter summarizes the general information on facilities and compiles a profile of reporting facilities.

Facilities were required to submit a separate TRI form for each TRI chemical they manufactured, processed, or otherwise used. As of March 15, 1989, 19,278 facilities submitted 74,152¹ TRI chemical forms for 1987, an average of four TRI chemicals per facility.

Facilities submitted more than 74,000 TRI chemical forms for 1987—an average of four chemicals per facility.

¹ Additional forms were received, but not included in TRI for one or more of the following reasons: they contained reporting errors that prevented data entry; they required further clarification by the reporting facility; or they reported on chemicals not on the TRI list (including such chemicals as titanium dioxide, which EPA removed from the TRI list — see Chapter 4).

Form Approved OMB No.: 2070-0093	
Approval Expires: 01/91	
Page 1 of 5	
(Important: Type or print; read instructions before completing form.) U.S. Environmental Protection Agency EPA TOXIC CHEMICAL RELEASE INVENTORY REPORTING FORM Section 313, Title III of The Superfund Amendments and Reauthorization Act of 1986 EPA FORM R	
PART I. FACILITY IDENTIFICATION INFORMATION	
(This space for EPA use only.)	
1. 1.1 Does this report contain trade secret information? ☐ Yes (Answer 1.2) ☐ No (Do not answer 1.2)	
1.2 Is this a sanitized copy? ☐ Yes ☐ No	
1.3 Reporting Year	
2. CERTIFICATION (Read and sign after completing all sections.) I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report. Name and official title of owner/operator or senior management official:	
Signature: _____ Date signed: _____	
3. FACILITY IDENTIFICATION	
Facility or Establishment Name: _____	
Street Address: _____	
3.1 City: _____ County: _____	
State: _____ Zip Code: _____	
3.2 Technical Contact: _____ Telephone Number (include area code): _____ () -	
3.4 Public Contact: _____ Telephone Number (include area code): _____ () -	
3.5 a. SIC Code: _____ b. _____ c. _____	
3.6 Latitude: _____ Longitude: _____ Deg. Min. Sec. Deg. Min. Sec.	
3.7 Dun & Bradstreet Number(s): _____ b. _____	
3.8 EPA Identification Number (RCRA 105 No.): _____ b. _____	
3.9 NPDES Permit Number(s): _____ b. _____	
Name of Receiving Stream(s) or Water Body(s): _____	
3.10 a. _____ b. _____ c. _____	
3.11 Underground Injection Well Code (UIC) Identification No.: _____	
4. PARENT COMPANY INFORMATION	
4.1 Name of Parent Company: _____	
4.2 Parent Company's Dun & Bradstreet No.: _____	
EPA Form 9350-1 (1-88)	

Figure 3-1.
TRI Form: Facility Identification Information, 1987. (See Appendix A for a sample of the full form.)

Geographical Distribution Of TRI Facilities

States

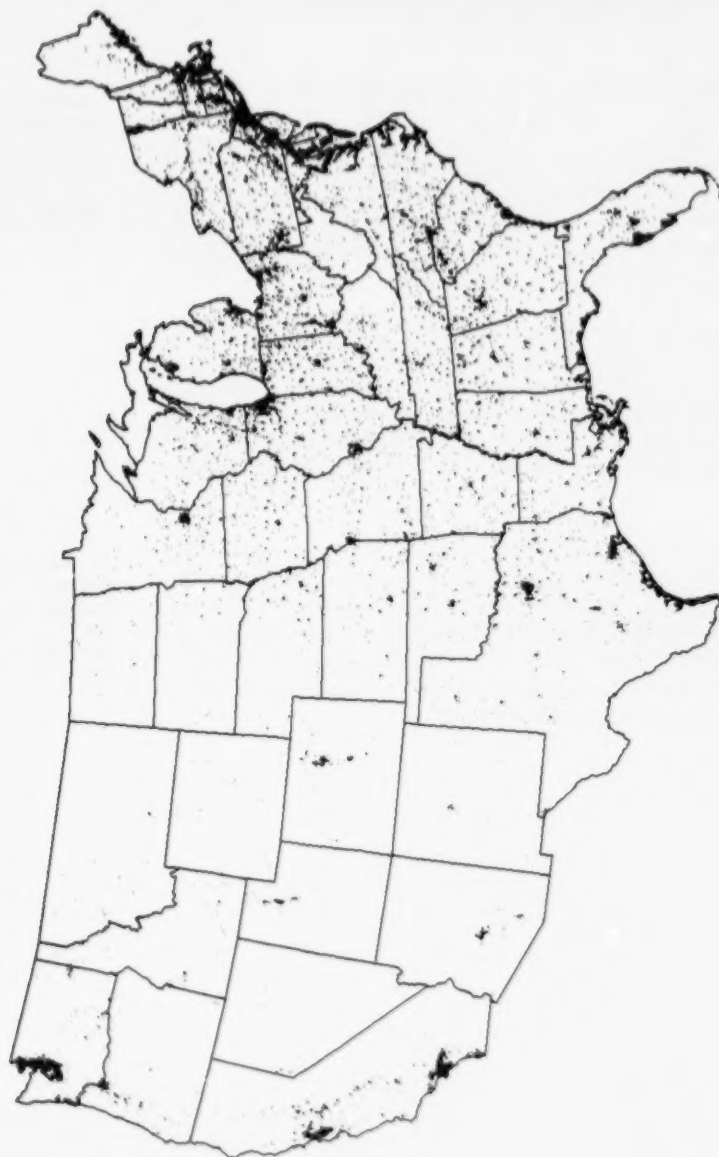
Facilities reported to TRI from all 50 states, Puerto Rico, the U.S. Virgin Islands, and American Samoa. No facilities reported from the District of Columbia or from the Commonwealth of the Northern Mariana Islands. The majority of facilities that reported 1987 TRI releases and transfers were in the industrial mid-Atlantic, Midwest, and Gulf Coast states, and in California (Map 3-1). The Rocky Mountain area, southwestern states, and northern New England had relatively few reporting facilities.

Table 3-1 shows the number of facilities in each state that reported to TRI for 1987. More than 91 percent (17,559) of these facilities indicated that their production or use of TRI chemicals resulted in releases to the environment or transfers off-site for treatment or disposal. The remaining nine percent (1,719 facilities) reported using TRI chemicals without any environmental releases or transfers off-site.

The 20 states with the greatest number of facilities reporting for 1987 are shown in Figure 3-2. Each of the top ten states had more than 700 facilities reporting, for a total of 10,072 facilities; together the facilities in these ten states represent more than 52 percent of the total number of facilities that reported. On the other end of the scale, the 13 states and territories with the smallest number of TRI facilities had 51 or fewer facilities each that reported for 1987.

Most facilities that reported to TRI were in the Mid-Atlantic, Midwest, and Gulf Coast states, and California.

Ten states accounted for more than 52 percent of the TRI facilities that reported to TRI for 1987.



Map 3-1. Facilities Reporting to TRI Nationwide, 1987. Each dot represents one facility.

TABLE 3-1 NUMBER OF TRI FACILITIES AND FORMS REPORTING BY STATE, 1987

STATE	TOTAL TRI FACILITIES REPORTING		TOTAL TRI FORMS REPORTING		AVERAGE NO. OF CHEMICALS REPORTED PER FACILITY	MAXIMUM NO. OF CHEMICALS REPORTED PER FACILITY
	Number	Percent	Number	Percent		
Alabama	355	1.84	1,508	2.03	4	28
Alaska	7	0.04	53	0.07	8	11
American Samoa	2	0.01	5	0.01	3	3
Arizona	156	0.81	545	0.73	3	21
Arkansas	203	1.52	988	1.33	3	25
California	1,662	8.62	5,630	7.86	4	54
Colorado	172	0.89	540	0.73	3	23
Connecticut	383	1.99	1,412	1.90	4	30
Delaware	53	0.27	263	0.35	5	25
Florida	419	2.17	1,331	1.79	3	19
Georgia	636	3.30	2,185	2.95	3	25
Hawaii	33	0.17	122	0.16	4	25
Idaho	52	0.27	163	0.22	3	14
Illinois	1,185	6.15	4,314	5.82	4	33
Indiana	720	3.73	2,790	3.78	4	38
Iowa	310	1.61	1,012	1.36	3	21
Kansas	184	0.95	742	1.00	4	31
Kentucky	298	1.55	1,353	1.82	5	38
Louisiana	259	1.34	1,818	2.45	7	55
Maine	83	0.43	380	0.49	4	14
Maryland	191	0.99	720	0.97	4	37
Massachusetts	580	2.90	1,852	2.50	3	23
Michigan	758	3.93	3,339	4.50	4	69
Minnesota	301	1.56	1,198	1.62	4	62
Mississippi	247	1.28	876	1.18	4	35
Missouri	503	2.61	1,902	2.57	4	33
Montana	27	0.14	148	0.20	5	22
Nebraska	139	0.72	424	0.57	3	12
Nevada	33	0.17	91	0.12	3	8
New Hampshire	129	0.67	435	0.59	3	38
New Jersey	875	4.54	3,280	4.42	4	47
New Mexico	32	0.17	119	0.16	4	12
New York	765	3.97	2,836	3.82	4	63
North Carolina	820	4.25	2,792	3.77	3	24
North Dakota	28	0.15	72	0.10	3	20
Ohio	1,281	6.54	5,116	6.90	4	33
Oklahoma	193	1.00	686	0.93	4	34
Oregon	217	1.13	705	0.95	3	18
Pennsylvania	1,027	5.33	3,989	5.38	4	42
Puerto Rico	172	0.89	572	0.77	3	14
Rhode Island	168	0.88	472	0.64	3	19
South Carolina	394	2.04	1,694	2.28	4	28
South Dakota	37	0.19	75	0.10	2	8
Tennessee	503	2.61	1,889	2.55	4	52
Texas	999	5.19	5,381	7.26	5	78
Utah	102	0.53	363	0.53	4	17
Vermont	52	0.27	158	0.21	3	14
Virgin Islands	1	0.01	24	0.03	24	24
Virginia	389	2.07	1,450	1.96	4	19
Washington	308	1.59	1,091	1.47	4	24
West Virginia	107	0.56	672	0.91	6	48
Wisconsin	645	3.35	2,239	3.02	3	19
Wyoming	27	0.14	128	0.17	5	22
TOTAL	19,278	100.00	74,152	100.00	4	82

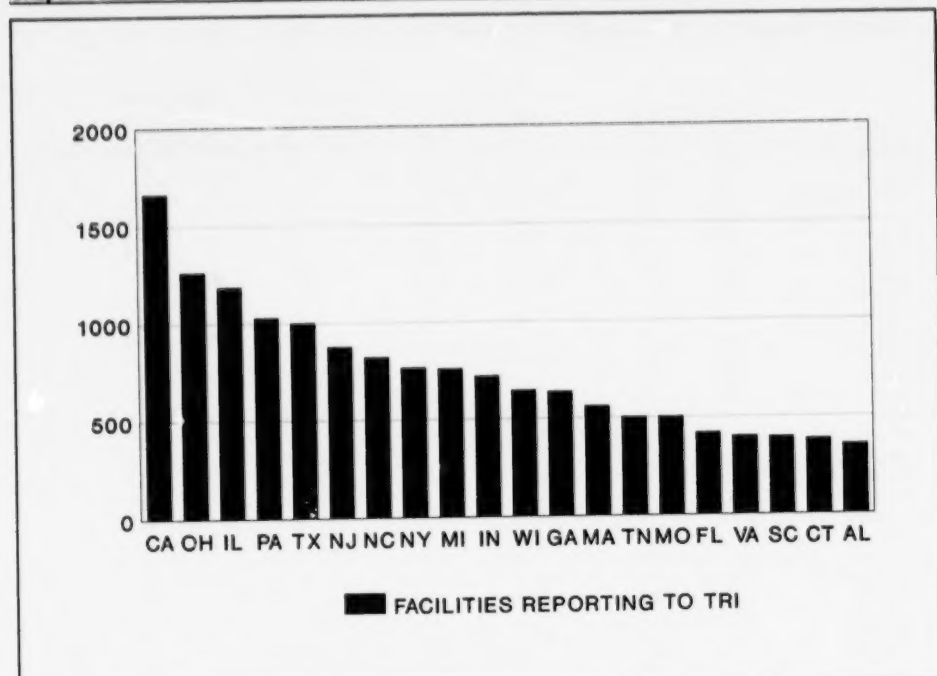


Figure 3-2.
The 20 States with the Largest Number of TRI Facilities Reporting, 1987.

Twenty-five counties accounted for 21 percent of facilities that reported to TRI in 1987.

Counties

Table 3-2 lists the 25 counties with the largest number of TRI facilities reporting for 1987. These 25 counties accounted for 21 percent of the facilities reporting to TRI in 1987. The table reveals that four California counties make up 28 percent (1,118) of the facilities in the table, and account for 6 percent of the facilities reporting nationwide for 1987. Four other counties listed in Table 3-2 are in states that were not among the top 20 states reporting for 1987 (Providence County, Rhode Island; King County, Washington; Maricopa County, Arizona; and Hennepin County, Minnesota).

Additional Geographical Information

Zip code areas and latitude and longitude coordinates are additional sources of geographical information requested by the TRI form. Latitude and longitude may be used to find exact locations of TRI facilities, as shown in Map 3-1 above. Chapter 12 illustrates several ways in which geographical coordinates in TRI may be used to analyze

TABLE 3-2. THE 25 COUNTIES WITH THE LARGEST NUMBER OF TRI FACILITIES REPORTING, 1987

COUNTY	STATE	TOTAL NO. OF TRI FACILITIES REPORTING	PERCENT OF TOTAL TRI FACILITIES IN THE STATE
LOS ANGELES	CA	676	40.67
COOK	IL	543	45.82
HARRIS	TX	207	20.72
ORANGE	CA	187	11.25
DALLAS	TX	157	15.72
CUYAHOGA	OH	155	12.29
WAYNE	MI	151	19.92
SANTA CLARA	CA	142	8.54
MIDDLESEX	NJ	139	15.89
MIDDLESEX	MA	136	24.29
MILWAUKEE	WI	134	20.78
PROVIDENCE	RI	118	71.08
NEW HAVEN	CT	115	30.03
KING	WA	114	37.25
HAMILTON	OH	114	9.04
ALAMEDA	CA	113	6.80
MARICOPA	AZ	107	68.59
BERGEN	NJ	104	11.89
ESSEX	NJ	101	11.54
MARION	IN	91	12.64
HENNEPIN	MN	91	30.23
TARRANT	TX	87	8.71
HARTFORD	CT	87	22.72
WORCESTER	MA	86	15.36
BRISTOL	MA	85	15.18
SUBTOTAL		4,040	
% OF GRAND TOTAL		20.96	
TOTAL FOR ALL OTHERS		15,238	
GRAND TOTAL		19,278	

regional or local patterns associated with the release of TRI chemicals.

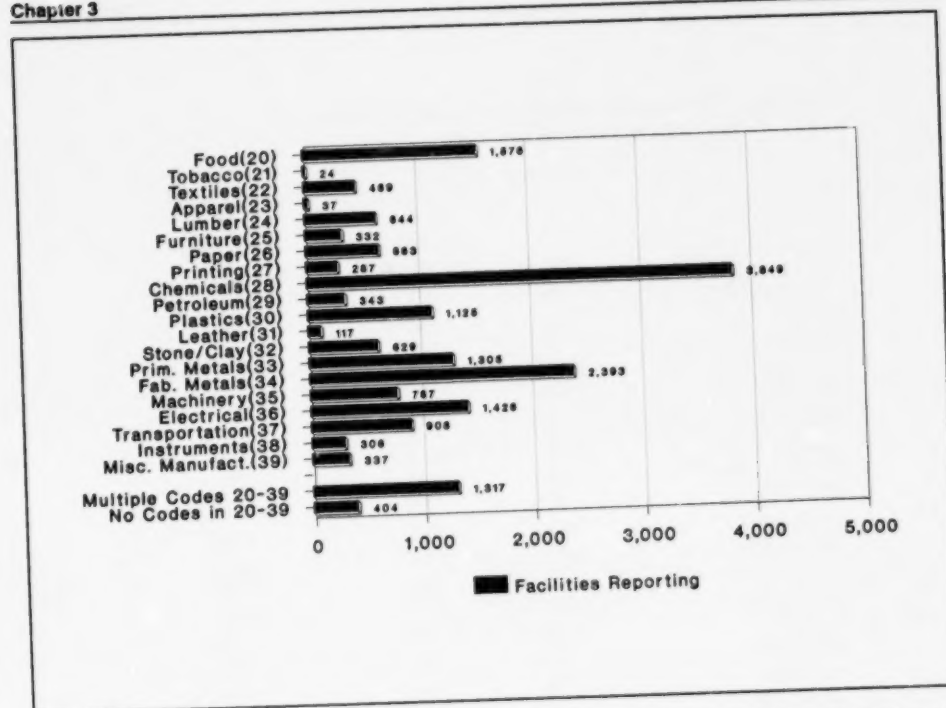


Figure 3-3. Distribution of TRI Facilities Reporting by Industry, 1987. Number of facilities reporting under each of the 20 Standard Industrial Classification (SIC) codes required to report to TRI.

Industrial Categories Of Reporting Facilities

Nearly half of the TRI facilities belong to four industries—the Chemical, Fabricated Metals, Food Products,

Nearly half of all the facilities reporting for 1987 (9,244 or 48 percent) fall into four industrial groups:² Chemical and Allied Products (3,849); Fabricated Metals (2,393); Food Products (1,576); and Electric and Electronic Equipment (1,426), (Figure 3-3, Table 3-3). Facilities in the Chemical industry alone accounted for 20 percent of the total number of facilities reporting to TRI for 1987. The industrial

² The TRI form requested that facilities identify the industry (or industries) to which they belong using the Standard Industrial Classification (SIC) Code, an industrial classification system used by the U.S. Department of Commerce. Appendix C lists the industries and SIC codes covered by TRI reporting requirements.

TABLE 3-3. TRI FACILITIES AND FORMS REPORTING BY INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL TRI FACILITIES REPORTING		TOTAL TRI FORMS REPORTING		AVERAGE NO. OF CHEMICALS REPORTED PER FACILITY	MAXIMUM NO. OF CHEMICALS REPORTED PER FACILITY
		Number	Percent	Number	Percent		
20	Food Products	1,576	8.18	3,441	4.64	2	15
21	Tobacco Manufacturers	24	0.12	80	0.11	3	13
22	Textile Mill Products	469	2.43	1,208	1.63	3	19
23	Apparel	37	0.19	65	0.09	2	5
24	Lumber and Wood Products	644	3.34	1,748	2.35	3	14
25	Furniture and Fixtures	332	1.72	1,349	1.82	4	23
26	Paper Products	663	3.44	2,050	3.57	4	18
27	Printing, Publishing	207	1.49	601	0.81	2	16
28	Chemical Products	3,849	19.97	21,219	28.62	5	74
29	Petroleum Refining	343	1.78	3,225	4.35	9	39
30	Rubber and Plastic Products	1,125	5.84	2,770	3.74	2	29
31	Leather Products	117	0.61	424	0.57	4	54
32	Stone, Clay, Glass Products	629	3.26	1,609	2.17	3	33
33	Primary Metals	1,305	6.77	5,587	7.53	4	38
34	Fabricated Metals	2,393	12.41	8,039	10.84	3	28
35	Machinery, except Electrical	787	4.08	2,242	3.02	3	22
36	Electric and Electronic Equip.	1,426	7.40	5,163	6.96	4	23
37	Transportation Equipment	908	4.71	4,483	6.05	5	29
38	Measuring, Photographic Goods	306	1.59	1,032	1.39	3	38
39	Misc. Manufacturing	337	1.75	911	1.23	3	20
	Multiple SIC codes in 20 - 39	1,317	6.83	5,065	6.83	5	82
	No SIC codes in 20 - 39	404	2.10	1,243	1.68	3	42
	TOTAL	19,278	100.00	74,152	100.00	4	82

categories accounting for the smallest number of facilities – less than two percent each – were Tobacco Manufacturers, Apparel, Leather Products, Printing and Publishing, Furniture and Fixtures, Measuring and Photographic Goods, Miscellaneous Manufacturing, and Petroleum Refining.

Seven percent of facilities reported more than one industrial category.

Over 250 facilities that reported to TRI did not belong to any of the industry categories covered by TRI requirements.

Approximately seven percent of the facilities listed more than one industrial category when reporting to TRI.³ Facilities may report under multiple industry groups for a variety of reasons. Manufacturers would belong to both the Petroleum Refining and the Chemical industries if they refine their own petroleum for chemical manufacturing. A large, diversified manufacturer may produce chemicals as well as rubber and plastic products; a facility in the Primary Metals industry might also make fabricated metal products; textile mills can make apparel with the fabric they manufacture; and so on. Counting these multiple-industry facilities with each of the industry groups they list does not significantly change the overall rankings for number of facilities.

More than 250 facilities that reported to TRI did not belong to any of the 20 manufacturing industries covered by TRI reporting requirements; another 152 facilities did not indicate their industry group (see Chapter 2 and Appendix C for a discussion of industries covered by TRI). The most frequently reported industry groups not covered by TRI were the Wholesale Trade-Nondurables industry (62 facilities), Nonmetallic Minerals, except Fuels (20 facilities); Business Services (18 facilities), and Wholesale Trade-Durables (18 facilities). It is unclear why facilities from these industries submitted TRI forms, although the facilities did report using TRI chemicals. For purposes of this report, all facilities outside SIC codes 20-39 are included in analyses, as appropriate, and are grouped together in a category entitled "No SIC codes in 20 - 39."

Other Facility Identification Information

TRI facilities were required to provide several identification numbers. Figure 3-4 illustrates the percentages of TRI identifiers that were filled in by reporting facilities for 1987.

Latitude and Longitude

Facilities were asked to supply latitude and longitude information, although such reporting was optional for the first year of TRI data collection (it will be required in all future reporting). For facilities that did not supply their geographical coordinates, EPA provided *approximate* latitude and longitude data based on the geographic

³ Throughout this report, facilities that listed more than one industry grouping (two-digit SIC code) are referred to as "multiple" industries (or "Multiple SIC Codes"). See the complete listing of SIC Codes in Appendix C.

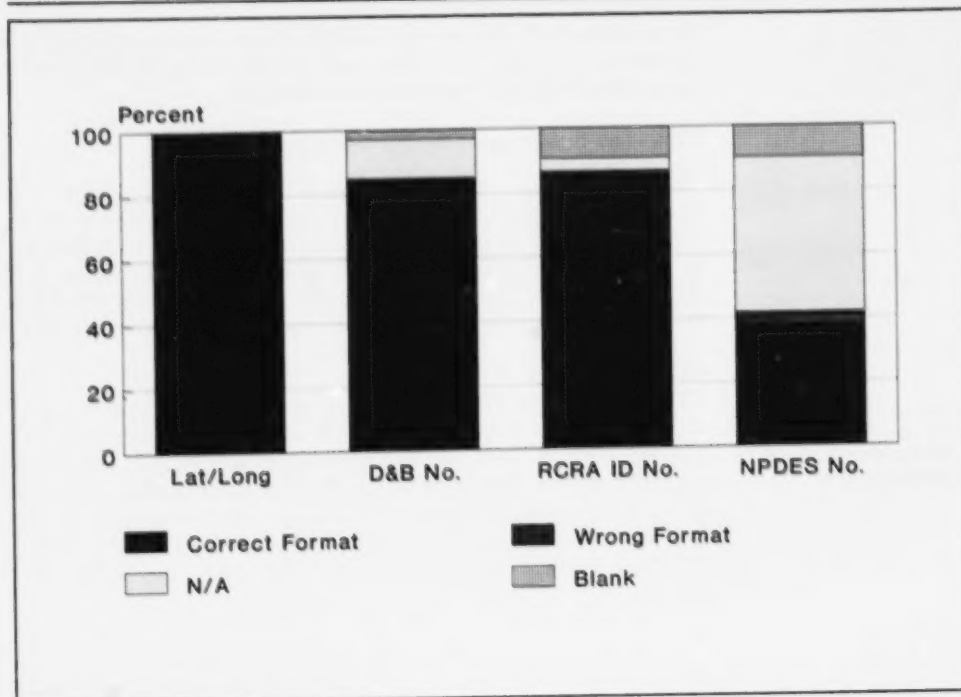


Figure 3-4. Facility Identifiers in the TRI Database, 1987. (Note that some latitude/longitude data was supplied by EPA—see text.)

center of the facilities' zip codes. Hence, latitude and longitude data in the TRI database is virtually complete.

Dun & Bradstreet Numbers

Facilities provided their Dun & Bradstreet (D&B) numbers, as well as those of their parent companies, where applicable. Dun & Bradstreet, a private financial reporting firm, assigns these identification numbers to many commercial establishments. Companies are not required to have D&B numbers, but enter the Dun & Bradstreet system as part of establishing commercial credit. Because D&B numbers are assigned and used in a financial context, there may be instances when the D&B number reported to TRI is the one associated with its business office and not the number assigned to the reporting facility.

Of the facilities that filed reports, 85 percent provided numbers consistent with the nine-digit format of a D&B number. Of the rest,

Over 85 percent of facilities provided Dun & Bradstreet numbers.

three percent left that part of the form blank, 12 percent listed "not applicable" for this identifier, and 0.4 percent provided invalid answers that did not conform to D&B format.

EPA Identification and Permit Numbers

Many TRI facilities are regulated under one or more environmental laws. Under statutes such as the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act, EPA assigns an identification or permit number to facilities that generate wastes or discharge their wastes into surface water or underground wells. TRI requested that facilities covered by such requirements report their assigned numbers.

RCRA Numbers

EPA assigns identification numbers to every waste-generating or handling facility regulated under the Resource Conservation and Recovery Act (RCRA). Of the TRI facilities filing reports, 86 percent provided RCRA Identification numbers with the correct format, 4 percent left the boxes blank, 10 percent entered some form of "not applicable" (including "N/A," "applied for," and "pending"), and less than one percent gave answers that were not in the appropriate format.

By using the RCRA numbers, TRI data could be paired with information reported to EPA and the states under the Resource Conservation and Recovery Act. For example, each biennial report summarizing hazardous waste generation and waste minimization efforts prepared under RCRA should correspond to the same identifying number as contained in TRI.

NPDES Numbers.

TRI facilities also reported their National Pollutant Discharge Elimination System (NPDES) permit number(s), where applicable. EPA and the states assign NPDES numbers to facilities for all water discharges regulated under the Federal Clean Water Act. Permits are typically issued on a facility basis, although some facilities have more than one NPDES number. Of those facilities filing TRI reports, 39 percent provided NPDES numbers, ten percent left the boxes blank, 48 percent entered "not applicable,"⁴ and three percent provided entries that were not in the appropriate EPA format. Some states, however, may have a different numbering system for water discharge

Eighty-six percent of facilities provided RCRA Identification numbers.

Thirty-nine percent of facilities provided NPDES permit numbers.

⁴ Facilities that discharge wastes to a public sewage treatment plant and/or do not discharge to surface waters do not need NPDES permits. This accounts, in part, for the large percentage of facilities entering "not applicable" on the TRI form.

permits issued under state statute, and thus a fraction of the three percent of entries with an inappropriate format may represent valid state permit numbers.

Valid NPDES numbers may provide a means of linking TRI data with other types of data, such as discharge permit requirements, Discharge Monitoring Reports (DMRs), and other information developed under state and federal implementation of the Clean Water Act, some of which is stored in existing databases such as EPA's Permit Compliance System.

UIC Numbers.

Another identifying number requested in the TRI form was the Underground Injection Well Code (UIC) number, assigned by EPA or the state under the authority of the Safe Drinking Water Act. A UIC number indicates that the facility has a permit to inject chemical-containing wastes into the ground in deep wells. A total of 636 forms (less than 1 percent of the total number submitted) contained UIC identification numbers. Because there is no fixed format for this number, it is not possible to determine to what extent the numbers in the database correspond with valid permit numbers.

Less than one percent of TRI forms provided UIC permit numbers.

Air Permit Numbers.

TRI did not require facilities to list air emissions permit numbers. The primary reason for not including air permit numbers as identifiers is that one facility may have hundreds of permits, often one for each smokestack or other fixed point of air pollution emission.

TRI Chemicals: Facility Activities and Uses

Number of Chemicals per Facility

The average number of chemicals reported per facility was four (Table 3-1 above). This average varied little among the states, ranging from three to five for most states. Alaska had the highest average (eight), while South Dakota had the lowest (two chemicals per facility).⁵ The maximum number of different chemicals reported to TRI by any one facility (a facility in Tennessee) was 82—fully one-fourth of the 328 TRI chemicals.

An average of four chemicals per facility was reported to TRI.

⁵ The Virgin Islands are an exception to the state averages. Only one facility in the Islands reported, and it reported on 24 chemicals—at once an average and a maximum.

3. ACTIVITIES AND USES OF THE CHEMICAL AT THE FACILITY (Check all that apply.)			
3.1	Manufacture:	a. ☐ Produce	b. ☐ Import
		d. ☐ For sale/distribution	e. ☐ As a byproduct
			f. ☐ For on-site use/processing
			g. ☐ As an impurity
3.2	Process:	a. ☐ As a reactant	b. ☐ As a formulation component
		d. ☐ Repackaging only	c. ☐ As an article component
3.3	Otherwise Used:	a. ☐ As a chemical processing aid	b. ☐ As a manufacturing aid
			c. ☐ Ancillary or other use

Figure 3-5.
TRI Form, 1987: Activities and Uses.

Ninety-four percent of facilities submitted one TRI form per chemical for the entire facility.

Facilities were permitted to submit one TRI form per chemical covering the entire facility. If more convenient, facilities could use more than one TRI form to cover different parts of the facility (warehouses, individual buildings, or other separate areas). The majority of facilities (94 percent) indicated that their submissions covered the entire facility, while three percent noted they had used individual TRI forms to cover parts of a facility. The remaining three percent of the facilities did not indicate whether their forms covered the whole facility or only a part of it.

Chemical Activities and Uses

TRI facilities were required to identify the types of activities and uses for each chemical (Figure 3-5). The major categories of activities and uses are **manufacture** (defined to include imports), **process**, and **otherwise used**, each with several subcategories.

Facilities were asked to report all relevant activities for each chemical they reported. For the sake of clarity, this report focuses only upon the major categories analyzing the uses of the chemicals by summarizing data reported by each in the following categories: *manufacture only*; *process only*; *other uses only*; and *combined uses* — combinations of two or more major categories. Except for the 198 facilities who left this section of the form blank, all TRI facilities (more than 99 percent of those reporting) can be placed into one of the categories.

Only one percent of TRI facilities reported manufacturing as their only use for a TRI chemical.

Only about one percent of the TRI facilities reported *manufacture only*; facilities reporting *process only* numbered almost 18 percent (Figure 3-6). Those reporting *other uses only* numbered 36 percent. Facilities reporting *combined uses* comprised the largest portion with 43 percent.

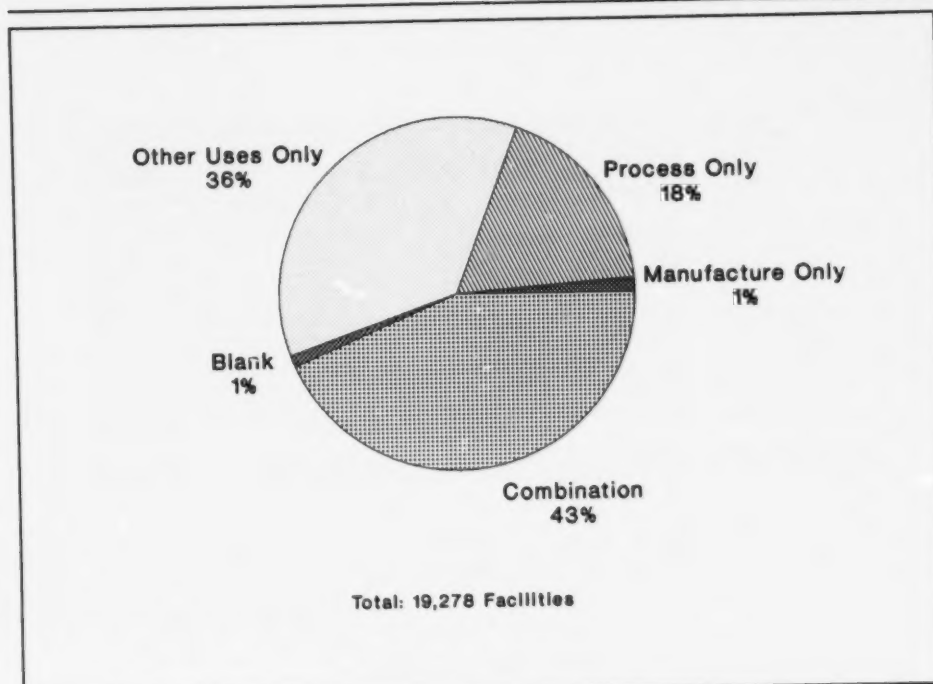


Figure 3-6.
Industrial Activities and Uses Reported by TRI Facilities, 1987.

The industrial classification of facilities is often related to the patterns of activity and use. Industrial sectors such as the Chemical and Allied Products industry have by their very nature a greater proportion of chemical manufacturing than do industries such as Food Products, which use chemicals rather than produce them. The correlation between industrial class and activity/use is evident in the breakdown of reported activities and uses by industry found in Figure 3-7.

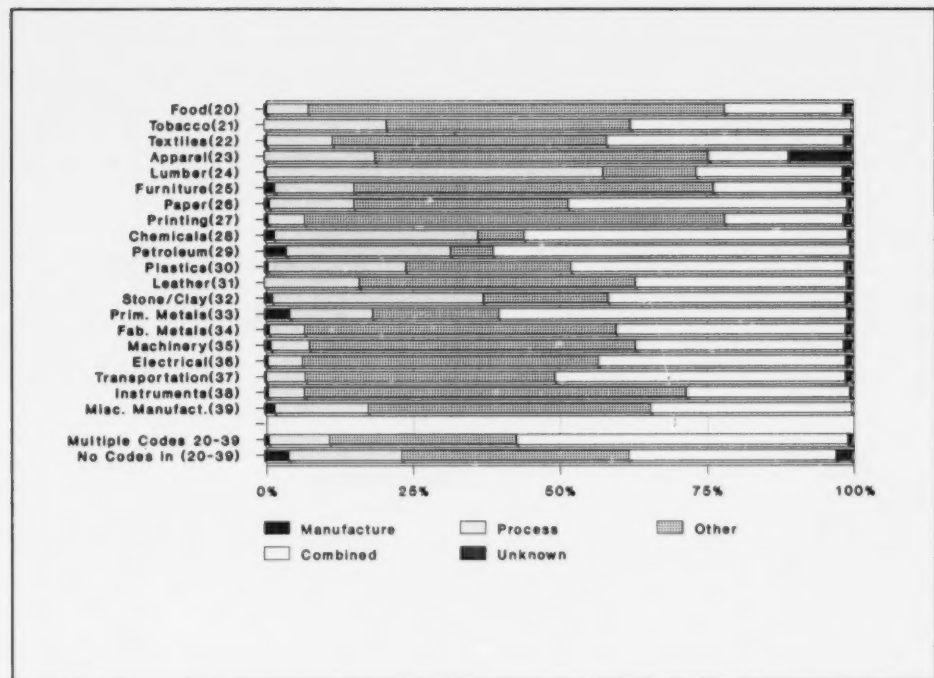


Figure 3-7.
TRI Facilities Reporting Activities and Uses by Industry, 1987. By Industrial Classification (SIC) Codes.



Chapter 4. TRI Chemicals

Introduction

This chapter discusses the number and amounts of chemical releases and transfers reported to the Toxic Release Inventory for 1987. The chapter then classifies the chemicals according to their chemical nature and examines how these classes of chemicals were reported in TRI.

It is important to note that several of the chemicals listed in TRI and considered in this chapter will almost certainly change for 1988 reporting. As discussed in Box 4-A, EPA has the authority to add or remove chemicals from the TRI. A chemical removed or added to the list can potentially have a large effect on total TRI data. (Box 4-E, at the end of chapter, further explores the definition of a toxic chemical under TRI.) For example, it is likely that sodium sulfate will be deleted from the list; this chemical represented 54 percent of all TRI releases and transfers in 1987. Clearly, the removal of sodium sulfate from the list will greatly change total release and transfer amounts, percentage comparisons, and other statistics (see Box 4-D). Two other proposed deletions, sodium hydroxide and aluminum oxide, also represented large releases and transfers in 1987 and would greatly alter the TRI release picture if they are removed from the TRI list.

The Number of TRI Chemical Forms and Total Releases and Transfers of TRI Chemicals

Individual Chemicals

Facilities submitted more TRI forms for sodium hydroxide than for any other chemical. Approximately one third of all facilities reported sodium hydroxide releases, accounting for nine percent of all forms (Table 4-1). Other commonly reported chemicals were sulfuric acid, toluene, 1,1,1-trichloroethane, all of which were reported by four percent or more of the TRI facilities. The top 25 TRI chemicals (ranked by how many forms were submitted) represented 69 percent of all TRI forms.

Twenty-five chemicals account for 69 percent of all TRI forms and over 94 percent of total 1987 releases and transfers.

CHANGES IN THE TRI CHEMICAL LIST

As noted in Chapter 2, the law creating TRI originally listed 309 individual chemicals and 20 chemical categories. Since then, several chemicals have been deleted from the TRI list due to an absence of toxicity concerns. Other chemicals have been *proposed* for deletion or addition, but final decisions have not yet been made. These changes and proposals are summarized below.

Deletions from the TRI chemical list made prior to 1987 reporting

- Titanium dioxide

Deletions from the TRI list after 1987 reporting (will affect 1988 reporting)

- Color Index (C.I.) Acid Blue #9, diammonium salt
- C.I. Acid Blue #9, disodium salt
- Melamine Crystal

Chemicals proposed for deletion from the TRI list

- Butyl benzyl phthalate
- Sodium hydroxide solution
- Sodium sulfate
- Aluminum oxide

Chemicals proposed for addition to the TRI list

- 2,3-Dichloropropene
- m-Dinitrobenzene
- p-Dinitrobenzene
- Allyl alcohol
- Diethylamine
- Isosafrole
- o-Dinitrobenzene
- Creosote
- Dinitrotoluene (mixed isomers)
- Toluene diisocyanate (mixed isomers)

In addition to the above changes, EPA also consolidated (prior to 1987 reporting) separate listings for "cyanide" and "cyanide compounds" into a single categorical listing (cyanide compounds), after determining that "cyanide" does not properly apply to a specific chemical.

Box 4-A.

TABLE 4-1. THE 25 CHEMICALS REPORTED ON THE MOST TRI FORMS, 1987

TOTAL RELEASE/ TRANSFER RANK	CHEMICAL NAME	NO. OF TRI FORMS REPORTING	PERCENT OF TRI FORMS REPORTING	FACILITIES REPORTING ONLY ONE CHEMICAL	
				Number	Percent of all Forms for the Chemical
6	SODIUM HYDROXIDE (SOLUTION)	6,815	9.19	822	12.06
5	SULFURIC ACID	4,944	6.67	270	5.46
9	TOLUENE	3,174	4.28	305	9.61
14	1,1,1-TRICHLOROETHANE	3,084	4.16	1	0.03
4	HYDROCHLORIC ACID	2,905	3.92	113	3.69
12	XYLENE (MIXED ISOMERS)	2,761	3.72	274	9.92
7	AMMONIA	2,421	3.26	364	15.04
13	METHYL ETHYL KETONE	2,102	2.83	157	7.47
11	ACETONE	2,089	2.82	166	7.95
10	PHOSPHORIC ACID	2,048	2.76	94	4.59
8	METHANOL	2,043	2.76	116	5.68
19	CHLORINE	1,738	2.34	123	7.08
22	NITRIC ACID	1,688	2.28	52	3.08
17	DICHLOROMETHANE	1,413	1.91	139	9.84
1	SODIUM SULFATE (SOLUTION)	1,401	1.89	23	1.64
15	COPPER	1,320	1.78	184	13.94
2	ALUMINUM OXIDE	1,303	1.76	243	18.65
30	ETHYLENE GLYCOL	1,192	1.61	120	10.07
16	ZINC COMPOUNDS	1,103	1.49	89	8.07
28	GLYCOL ETHERS	1,035	1.40	64	6.18
25	FREON 113	1,033	1.39	244	23.62
31	N-BUTYL ALCOHOL	899	1.21	15	1.67
26	TRICHLOROETHYLENE	868	1.17	195	22.47
44	CHROMIUM COMPOUNDS	847	1.14	42	4.96
27	STYRENE	847	1.14	104	12.28
	SUBTOTAL	51,073	68.88	4,319	8.46
	TOTAL FOR ALL OTHERS	23,079	31.12	2,177	9.43
	GRAND TOTAL	74,152	100.00	6,496	8.76

Table 4-1 also indicates the number of TRI facilities that reported releases and transfers of a single TRI chemical. The table shows distinct differences in the extent to which various TRI chemicals were the sole focus of TRI reporting at facilities. For example, 244 (24 percent) of the 1,033 forms reporting Freon 113 were from facilities reporting only this TRI chemical, whereas only 1 of the 3,084 TRI forms filed for 1,1,1-trichloroethane came from a facility reporting only on this chemical.

TRI data on the amounts of releases and transfers gives a very different picture than the data on the number of forms. Of the total reported releases and transfers, sodium sulfate and aluminum oxide dominated, accounting for 64 percent of the total. Releases and transfers of these two chemicals totaled 12.1 (54 percent) and 2.4 (10 percent) billion pounds, respectively. Four additional chemicals were released and transferred in amounts larger than 500 million pounds: ammonium sulfate, hydrochloric acid, sulfuric acid, and sodium hydroxide. In all, the top 25 TRI chemicals, ranked by total releases and transfers, comprised 94 percent of the total reported for all chemicals (Table 4-2). No single TRI chemical beyond the top 25 accounted for even 0.3 percent of the total TRI releases and transfers (see Boxes 4-B and 4-C).

Sodium sulfate accounts for more than half of the total TRI releases and transfers.

The chemicals reported most frequently were not always the chemicals released and transferred in the largest amounts. For example, sodium hydroxide, which was reported by the largest number of TRI facilities, ranked sixth for total releases and transfers. Sodium sulfate, which represented the largest total amount of releases and transfers for any single TRI chemical by far (54 percent of all releases and transfers) ranked only fifteenth for the number of TRI forms reported (2 percent). In other cases, the release patterns and release amounts were more closely correlated. For example, ammonia had the seventh largest number of forms and releases, and phosphoric acid ranked tenth on each list.

Fifty-five TRI chemicals were not reported; three other chemicals were reported but were not released to the environment or transferred off-site.

TRI facilities did not report any information on 55 TRI chemicals (Table 4-3). Some of the unreported chemicals are not in commerce in the United States. Other unreported chemicals may have been manufactured, processed, or used in 1987 at facilities that were not required to file TRI forms. (Chapter 2 describes which facilities were required to report). Lastly, it is possible that one or more chemicals should have been reported, but the covered facilities did not submit the required TRI forms.

CHEMICALS VS. WASTES

TRI releases are reported on a chemical basis. For example, 1 million pounds of a 10 percent sodium hydroxide solution is to be reported as 100,000 pounds of sodium hydroxide (not 1 million pounds). Thus, TRI provides information on the amount of the listed chemicals, but provides no direct information on the volume or amounts of waste in which the chemical is present.

Box 4-B.

TABLE 4-2. NUMBER OF FORMS AND TOTAL RELEASES AND TRANSFERS FOR THE 25 CHEMICALS WITH THE LARGEST RELEASES AND TRANSFERS

TOTAL TRI RELEASE/ TRANSFER	Rank	CHEMICAL NAME	TOTAL TRI FORMS WITH RELEASES/ TRANSFERS		TOTAL TRI RELEASES/ TRANSFERS	
			Number	Percent	Pounds	Percent
	1	SODIUM SULFATE (SOLUTION)	1,329	1.79	12,079,565,192	53.64
	2	ALUMINUM OXIDE	1,196	1.62	2,434,973,644	10.81
	3	AMMONIUM SULFATE (SOLUTION)	256	0.35	917,843,518	4.06
	4	HYDROCHLORIC ACID	2,278	3.07	656,744,356	2.92
	5	SULFURIC ACID	3,133	4.23	642,751,448	2.85
	6	SODIUM HYDROXIDE (SOLUTION)	4,288	5.78	626,849,514	2.78
	7	AMMONIA	2,158	2.91	444,484,887	1.97
	8	METHANOL	1,906	2.57	419,546,588	1.86
	9	TOLUENE	3,099	4.18	344,565,192	1.53
	10	PHOSPHORIC ACID	1,235	1.67	343,922,311	1.53
	11	ACETONE	2,022	2.73	234,592,029	1.04
	12	XYLENE (MIXED ISOMERS)	2,680	3.61	217,664,213	0.97
	13	METHYL ETHYL KETONE	2,051	2.77	192,748,517	0.86
	14	1,1,1-TRICHLOROETHANE	2,988	4.03	181,918,560	0.81
	15	COPPER	1,076	1.45	177,878,091	0.79
	16	ZINC COMPOUNDS	1,002	1.35	176,576,887	0.78
	17	DICHLOROMETHANE	1,360	1.83	152,289,040	0.68
	18	CARBON DISULFIDE	80	0.11	136,715,512	0.61
	19	CHLORINE	1,427	1.92	131,235,577	0.58
	20	AMMONIUM NITRATE (SOLUTION)	143	0.19	114,848,028	0.51
	21	MANGANESE COMPOUNDS	295	0.40	114,736,785	0.51
	22	NITRIC ACID	1,300	1.75	98,136,781	0.44
	23	ZINC (FUME OR DUST)	499	0.67	91,347,809	0.41
	24	ETHYLENE	238	0.32	69,472,028	0.31
	25	FREON 113	1,006	1.36	62,361,207	0.28
		SUBTOTAL	39,049	52.66	21,063,767,712	93.54
		TOTAL FOR ALL OTHERS	35,103	47.34	1,455,276,379	6.46
		GRAND TOTAL	74,152	100.00	22,519,044,091	100.00

EPA received TRI forms on three chemicals (nitrogen mustard, polybrominated biphenyls, and propane sultone) that had no reported releases to the environment or off-site transfers. In other words, the chemicals were used by TRI facilities, but this use did not result in any releases or transfers. In addition, two chemicals, 4-aminobiphenyl and bis(chloromethyl) ether, had less than ten pounds of total releases and transfers and 14 others had less than 1,000 pounds.

TABLE 4-3. THE 55 CHEMICALS WITH NO TRI FORMS, 1987

SIMPLE ACIDS, BASES, SALTS	
All Reported	
NON-METALLIC INORGANICS	
All Reported	
METALS AND METALLIC COMPOUNDS	
C.I. Direct Brown 95	
Osmium Tetroxide	
HALO-ORGANICS	
1,2-Dibromo-3-chloropropane	
2,4,5-Trichlorophenol	
Aldrin	
bis(2-Chloro-1-methylethyl)ether	
Bromoform	
Hexachloronaphthalene	
Octachloronaphthalene	
o-Anisidine Hydrochloride	
o-Toluidine Hydrochloride	
Toxaphene	
tris(2,3-Dibromopropyl)phosphate	
ORGANICS	
1,2-Diphenylhydrazine	
1-Amino-2-methylantraquinone	
2-Acetylaminofluorene	
2-Aminanthraquinone	
3,3'-Dimethoxybenzidine	
3,3'-Dimethylbenzidine	
4,4'-Thiodianiline	
4-Dimethylaminoazobenzene	
4-Nitrobiphenyl	
ORGANICS (Continued)	
Benzamide	
Benzidine	
beta-Naphthylamine	
beta-Propiolactone	
C.I. Acid Green 3	
C.I. Basic Red 1	
C.I. Direct Black 38	
C.I. Direct Blue 6	
C.I. Disperse Yellow 3	
C.I. Food Red 15	
C.I. Food Red 5	
C.I. Solvent Orange 7	
C.I. Solvent Yellow 34 (Auramine)	
C.I. VAT Yellow 4	
Diallate	
Diazomethane	
Diepoxybutane	
Dimethylcarbaryl Chloride	
Hexamethylphosphoramide	
Mustard Gas	
Nitrofen	
N-Nitrosodiethylamine	
N-Nitrosodimethylamine	
N-Nitrosodi-N-butylamine	
N-Nitrosodi-N-propylamine	
N-Nitrosomethylvinylamine	
N-Nitrosomorpholine	
N-Nitrosornicotine	
N-Nitrosopiperidine	
N-Nitroso-N-ethylurea	
N-Nitroso-N-methylurea	
Thioacetamide	
Triaziquone	

Chemical Categories

Approximately nine percent of the TRI forms filed for 1987 reported on at least one of the 20 TRI chemical categories – 6,403 out of a total of 74,152 forms. (The chemical categories are briefly explained in Chapter 2, page 27.) Releases and transfers were reported for all TRI chemical categories except polybrominated biphenyls. The number of TRI forms and total releases and transfers for the 20 categories are provided in Table 4-4. Chemical categories accounted for 529 million pounds of total releases and transfers, two percent of releases and transfers for all chemicals. (See also Box 4-C.)

Nine percent of the TRI forms reported chemical categories, and they comprised two percent of all TRI releases and transfers.

TABLE 4-4. NUMBER OF FORMS AND TOTAL RELEASES AND TRANSFERS FOR ALL TRI CHEMICAL CATEGORIES, 1987

TOTAL RELEASES/ TRANSFERS RANK	CHEMICAL CATEGORY	TOTAL TRI FORMS REPORTING		TOTAL TRI RELEASES/ TRANSFERS	
		Number	Percent	Pounds	Percent
89	ANTIMONY COMPOUNDS	174	0.23	3,617,605	0.02
49	ARSENIC COMPOUNDS	210	0.28	27,133,899	0.12
54	BARIUM COMPOUNDS	397	0.54	19,347,931	0.09
237	BERYLLIUM COMPOUNDS	8	0.01	7,822	0.00
118	CADMIUM COMPOUNDS	82	0.11	1,494,111	0.01
103	CHLOROPHENOLS	14	0.02	2,198,485	0.01
44	CHROMIUM COMPOUNDS	847	1.14	32,063,847	0.14
152	COBALT COMPOUNDS	117	0.16	569,936	0.00
32	COPPER COMPOUNDS	701	0.95	44,155,900	0.20
64	CYANIDE COMPOUNDS	361	0.49	10,386,288	0.05
28	GLYCOL ETHERS	1,035	1.40	53,210,217	0.24
46	LEAD COMPOUNDS	535	0.72	30,019,072	0.13
21	MANGANESE COMPOUNDS	342	0.46	114,736,785	0.51
199	MERCURY COMPOUNDS	21	0.03	85,935	0.00
58	NICKEL COMPOUNDS	410	0.55	13,275,864	0.06
274	POLY BROMINATED BIPHENYL	1	0.00	0	0.00
173	SELENIUM COMPOUNDS	12	0.02	282,766	0.00
210	SILVER COMPOUNDS	32	0.04	47,369	0.00
268	THALLIUM COMPOUNDS	1	0.00	250	0.00
16	ZINC COMPOUNDS	1,103	1.49	176,576,887	0.78
	SUBTOTAL	6,403	8.63	529,210,969	2.35
	TOTAL FOR ALL OTHERS	67,749	91.37	21,989,833,122	97.65
	GRAND TOTAL	74,152	100.00	22,519,044,091	100.00

The 328 TRI chemicals are grouped into five classes in this report.

Twelve simple acids, bases, and salts accounted for 29 percent of all TRI forms and 69 percent of all releases and transfers.

Reporting and Releases and Transfers By Chemical Class

To facilitate discussions of different chemicals, we grouped both chemicals and categories into a limited number of classes based on their chemical similarity. We chose the following classes, which are defined in subsequent sections.

- simple acids, bases, and salts
- organics
- metals and metal compounds
- halo-organics
- non-metallic inorganics

Although they are not chemically related, we also treated "Mixtures" and "Trade Secrets" as classes, because they could not be merged into the other classes. TRI forms reporting on mixtures did not identify release and transfer amounts to specific chemicals.¹ Thus, the mixture release and transfer amounts could not be directly added to the appropriate classes. Additionally, generic names in trade secret reports did not always indicate the chemical type clearly enough to classify them.

Two chemical classes—acids/bases/salts and non-metallic inorganics—accounted for almost 85 percent of the total amount of releases and transfers. The 12 acids/bases/salts accounted for 29 percent of all forms submitted to TRI and 69 percent of the total release (Figure 4-1).

Acids/Bases/Salts

Eleven TRI chemicals and one category (cyanide compounds) are simple acids, bases, and salts. Six of the acids, bases, and salts accounted for 25 percent of all TRI forms, 87 percent of the TRI forms for the class, 68 percent of total releases and transfers, and 98 percent of all releases and transfers by the class (Figure 4-2). The six chemicals are sodium sulfate, ammonium sulfate, hydrochloric acid, sulfuric acid, sodium hydroxide, and phosphoric acid.

1 "Mixtures" were intended under TRI to cover reports where a facility was uncertain of the actual identity of a TRI toxic chemical.

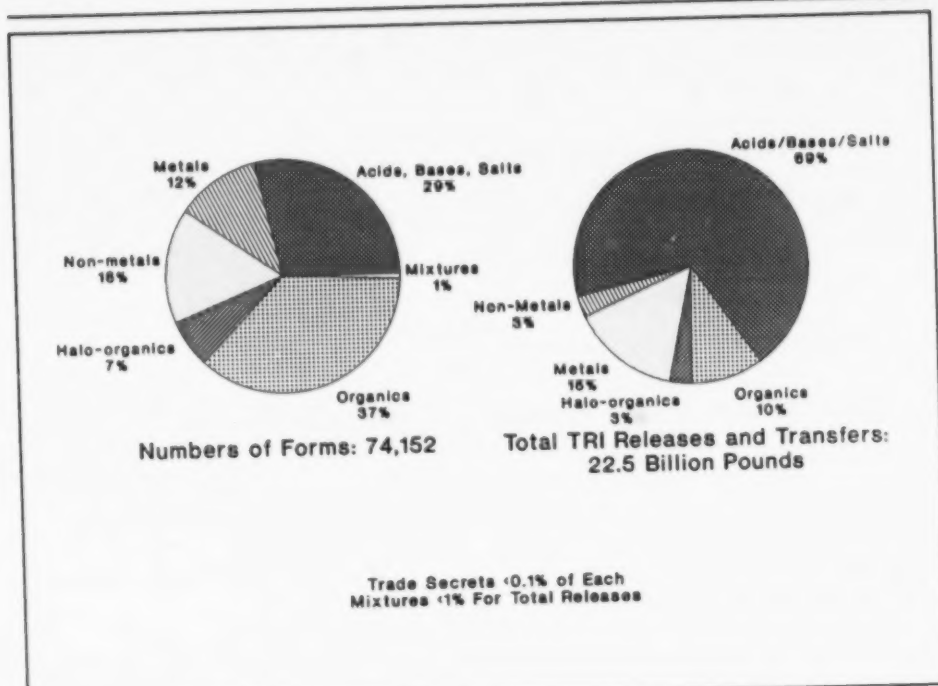


Figure 4-1. Number of TRI Forms Submitted and Total Releases by Chemical Class, 1987. Trade secrets comprised less than 0.1% and mixtures less than 1% of total TRI releases and transfers.

Organics (non-halogenated)

The largest number of TRI chemicals can be classified broadly as organics—carbon-containing compounds—that also have no fluorine, chlorine, bromine, or iodine atoms. Facilities reported releases and transfers of 155 organics. This class contains many chemicals that cause a variety of health and environmental harms. Organics represented 37 percent of all TRI forms and ten percent of the total amount of TRI chemicals released and transferred.

Five organics (methanol, toluene, acetone, xylene (mixed isomers) and methyl ethyl ketone) accounted for 45 percent of the total number of TRI forms and 60 percent of the total releases and transfers of the class (Figure 4-3). (See also Box 4-C regarding xylene.)

The 155 organics accounted for 37 percent of all forms and 10 percent of all releases and transfers.

Chapter 4

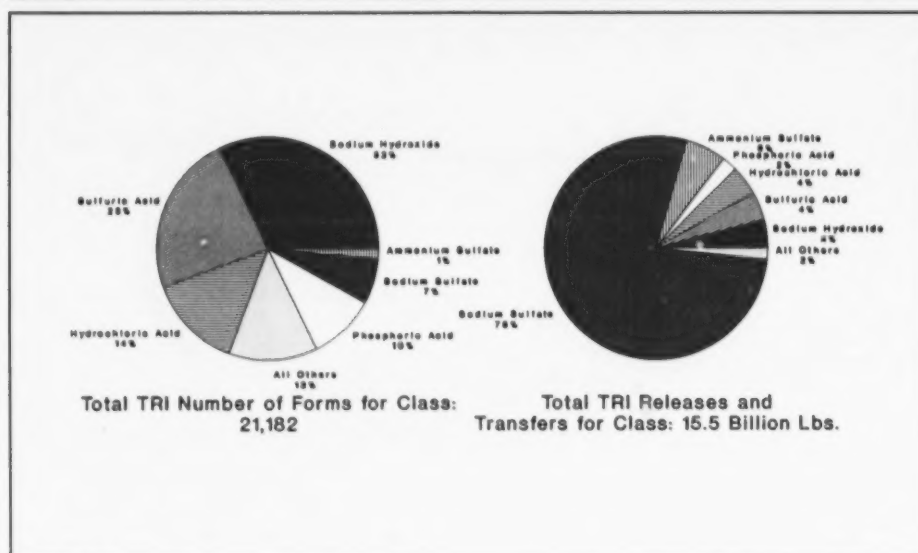


Figure 4-2.
Forms and Total TRI Releases and Transfers for Acids/Bases/Salts, 1987.

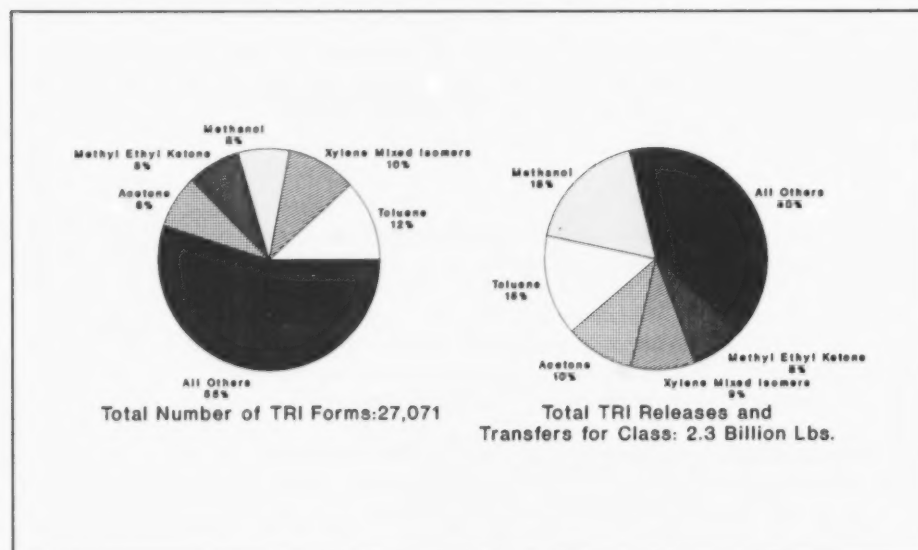


Figure 4-3.
Forms and Total TRI Releases and Transfers for Organics (non-halogenated), 1987.

MULTIPLE FORMS OF A CHEMICAL IN TRI

The list of chemicals and categories subject to TRI reporting in some cases contain more than one related chemical entry. For example, "zinc (fume or dust)," "zinc compounds," and the zinc containing chemical "Zineb" are subject to separate reporting. Similarly "chromium" and "chromium compounds" are to be reported separately and "*m*-Xylene," "*o*-Xylene," and "*p*-Xylene," and the chemical "Xylene (mixed isomers)" are all in the database individually. If the reports for individual isomers and the mixed isomer group are combined, total xylene releases would rank higher.

Figures in this report are presented by the separate TRI entry and do not aggregate releases and transfers of related chemicals (except in Chapter 12 where an example of aggregating such related chemicals is provided for all TRI listings related to lead).

Box 4-C.

Metals and Metal Compounds

Thirty-six of the TRI chemicals are metals or metal compounds. Many metals are of concern because they are toxic and because metals cannot be further broken down, and thus made potentially less harmful. TRI forms reporting metal and metal compound releases and transfers accounted for 12 percent of all TRI forms filed and 15 percent of the total amount of TRI releases and transfers.

The five metals and metal compounds with the greatest number of forms were copper, aluminum oxide, zinc compounds, manganese compounds, and zinc (fume or dust) (Figure 4-4). These five chemicals accounted for 39 percent of the forms reported for the class and 90 percent of all their releases and transfers.² Aluminum oxide, the chemical with the second largest amount of releases and transfers in the TRI database, dominated the totals of this class, accounting for more than 73 percent of the releases and transfers of all metals and metal compounds. As is the case with sodium sulfate, aluminum oxide is also being reviewed by EPA for possible removal from the TRI list of chemicals.

The 36 metals and metal compounds represent 12 percent of all forms and 15 percent of all releases and transfers.

Aluminum oxide accounted for 73 percent of releases and transfers of metals.

² If related chemicals were aggregated (for example, if individually-reported releases and transfers of zinc compounds, such as "Zineb," were added to the totals for the zinc compound category), the sum would be even larger.

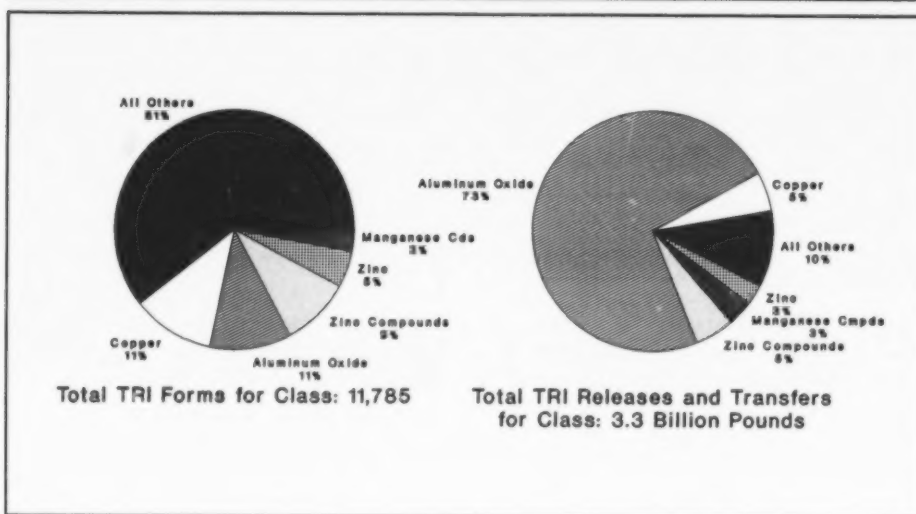


Figure 4-4.
Forms and Total TRI Releases and Transfers for Metals and Metal Compounds, 1987.

Halo-organics

For the purposes of this report, organic chemicals that contain one or more halogen (fluorine, chlorine, bromine, or iodine) atoms are classified in a single class, the halo-organics. This class contains a variety of chemicals, including some chlorinated hydrocarbons that have been the subject of extensive environmental regulation (such as carbon tetrachloride or chloroform), as well as lesser known chemicals. Halo-organics also include chemicals such as anisidine hydrochloride and toluidine hydrochloride, which share few of the chemical properties normally associated with halogenated organics, hence we have coined the name "halo-organics" to distinguish this class from its more familiar subset.

The 71 halo-organics represent seven percent of all forms and three percent of all releases and transfers.

The 71 halo-organics accounted for only seven percent of TRI forms filed and an even smaller percentage of all releases and transfers—three percent. The five halo-organic chemicals that accounted for the largest number of TRI forms and releases and transfers for the class were 1,1,1-trichloroethane; dichloromethane; Freon 113; trichloroethylene; and tetrachloroethylene (Figure 4-5). The chemical 1,1,1-trichloroethane accounted for the largest number of forms and releases and transfers for the class with 36 percent of the forms and 30 percent of the releases and transfers.

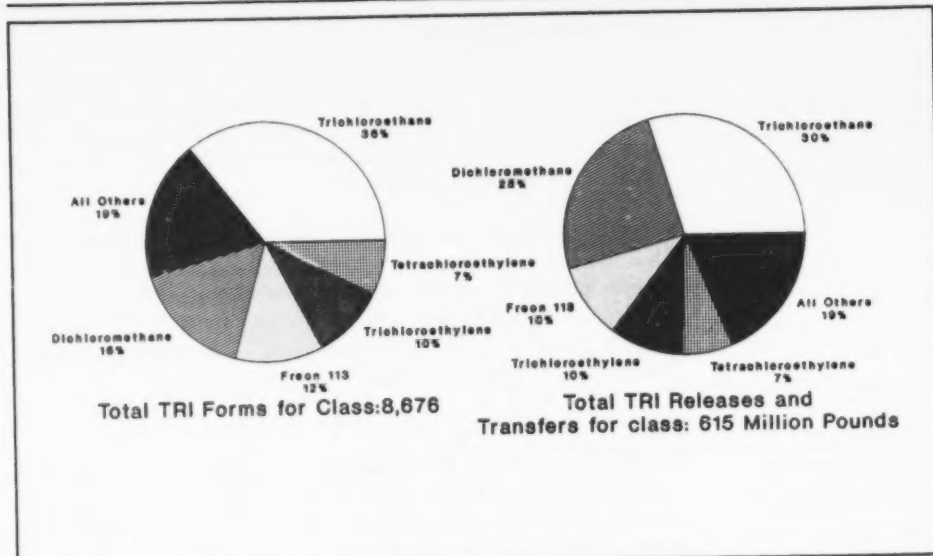


Figure 4-5.
Forms and Total TRI Releases and Transfers for Halo-Organics, 1987.

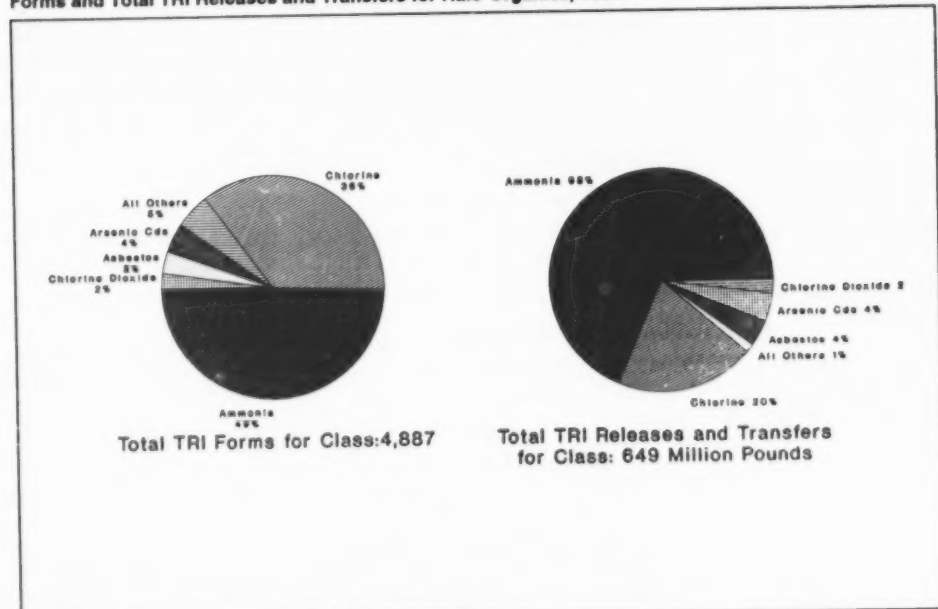


Figure 4-6.
Forms and Total TRI Releases and Transfers for Non-Metallic Inorganics, 1987.

The ten non-metallic inorganic chemicals account for 16 percent of all forms and 3 percent of all releases and transfers.

A total of 509 forms reported mixtures and trade name products. They accounted for approximately 0.2 percent of all releases and transfers.

A total of 40 forms had trade secrecy claims for chemical identity covering less than 0.01 percent of all releases and transfers.

Non-metallic Inorganics

The ten TRI chemicals classified as non-metallic inorganic chemicals vary in structure, properties, and environmental concern. Among them are friable asbestos, which is of concern mainly because of health effects associated with breathing its fibrous form; toxic arsenic; and flammable elemental phosphorous.

Non-metallic inorganics accounted for 16 percent of all TRI forms received and three percent of the total releases and transfers. The top five non-metallic chemicals — ammonia, chlorine, arsenic compounds, asbestos (friable), and chlorine dioxide — accounted for 95 percent of the forms filed for this class and 99 percent of the total releases and transfers for the class (Figure 4-6).

Mixtures

TRI facilities reported on 509 mixtures on approximately 0.7 percent of all TRI forms submitted. The TRI forms that provided a mixture or trade name product generally used unique names, although 44 were noted numerous times (Table 4-5).

Releases and transfers of mixtures totalled approximately 42 million pounds, or about 0.2 percent of all releases and transfers. The 25 mixtures that represented the largest releases and transfers are listed in Table 4-6. These 25 mixtures represent 11 percent of the forms and 83 percent of the releases for mixtures.³

Trade Secrets

Twenty-eight facilities submitted 40 TRI forms with the chemical identity claimed as a trade secret (representing 0.06 percent of all forms).⁴ A list of facilities and the releases and transfers of all forms with trade secrecy claims is found in Table 4-7.

The 40 forms with trade secret claims comprised 0.01 percent of all releases and transfers. Eight forms reported zero releases, seven

3 A number of facilities reported individual TRI chemicals, such as toluene, as mixtures. These reports may represent a best guess as to the TRI chemical contained in the mixture, or they may be in error. When the chemical composition of a mixture is known, facilities must provide separate reports for each TRI chemical contained in the mixture.

4 As described in Chapter 2, TRI requirements allow facilities to claim only the chemical identity trade secret on a TRI report, and only under criteria that must be substantiated when the report is filed. Trade secret claims are supposed to be accompanied by generic names describing the structure of the chemical.

TABLE 4-5. TRI MIXTURES/TRADE NAME PRODUCT NAMES REPORTED
ON MORE THAN ONE FORM, 1987

MIXTURE NAME	TOTAL TRI FORMS REPORTING		TOTAL TRI RELEASES/ TRANSFERS	
	Number	Percent	Pounds	Percent
TOLUENE	7	1.38	177,039	0.43
UNKNOWN	7	1.38	4,919,213	11.82
METHYL ETHYL KETONE	6	1.18	146,180	0.35
SODIUM HYDROXIDE	6	1.18	240,350	0.58
ACETONE	5	0.98	194,787	0.47
XYLENE	5	0.98	129,355	0.31
DIESEL FUEL (PETROLEUM HYDROCARBON)	4	0.79	0	0.00
ETHYLENE GLYCOL	4	0.79	23,750	0.06
METHYL ISOBUTYL KETONE	4	0.79	33,214	0.08
PHOSPHORIC ACID	4	0.79	19,876	0.05
SULFURIC ACID	4	0.79	1,500	0.00
AROMATICS	3	0.59	17,500	0.04
CHLORINATED SOLVENTS	3	0.59	31,411	0.08
CHROMIUM COMPOUNDS	3	0.59	146,056	0.35
COPPER COMPOUNDS	3	0.59	109,954	0.26
HYDROCHLORIC ACID	3	0.59	961	0.00
ISOPROPYL ALCOHOL	3	0.59	228,025	0.54
METHYLENE CHLORIDE	3	0.59	291,786	0.70
NICKEL COMPOUNDS	3	0.59	357,767	0.86
NONCHLORINATED SOLVENTS	3	0.59	1,150,250	2.76
STODDARD SOLVENT	3	0.59	38,330	0.09
ZINC COMPOUNDS	3	0.59	10,939	0.03
ALUMINUM COMPOUNDS	2	0.39	53,780	0.13
AMINE METHANEARSONATES	2	0.39	0	0.00
AMMONIUM HYDROXIDE, AMMONIUM CHLORIDE, AMMONIUM CARBONATE	2	0.39	500	0.00
BARIUM COMPOUND	2	0.39	6,955	0.02
CADMIUM COMPOUNDS	2	0.39	44,710	0.11
CHLORINE	2	0.39	3,500	0.01
CLEAR ACRYLIC TOPCOAT	2	0.39	11,534	0.03
CLEAR STRIP COATING	2	0.39	23,820	0.06
COBALT COMPOUNDS	2	0.39	28,041	0.07
COPPER (FOUND IN BRASS, TUBING AND PLATING CHEMICALS)	2	0.39	1,000	0.00
FURAN PHENOLIC RESIN - CORE LUBE 1000	2	0.39	4,500	0.01
HYDROCARBON TURBINE FUEL - NAPHTHALENE	2	0.39	250	0.00
ISOPROPYL ALCOHOL	2	0.39	39,026	0.09
LEAD (FOUND IN BRASS)	2	0.39	250	0.00
MANGANESE COMPOUNDS	2	0.39	14,902	0.04
NITRIC ACID	2	0.39	10,230	0.02
PART OF PAINT PRODUCT - NAPTHA # 64742-89-8	2	0.39	5,460	0.01
SOAPS & DETERGENTS	2	0.39	0	0.00
STAIN, LACQUER, SEALER, SOLVENT	2	0.39	330,460	0.79
STYRENE	2	0.39	3,450	0.01
WASH OFF	2	0.39	53,519	0.13
WELDWOOD CONTACT CEMENT #0307	2	0.39	0	0.00
ZINC (FOUND IN BRASS)	2	0.39	1,250	0.00
SUBTOTAL	135	26.52	8,903,200	21.39
TOTAL FOR ALL OTHERS	374	73.48	32,722,059	78.61
GRAND TOTAL	509	100.00	41,625,259	100.00

TABLE 4-8. THE 25 MIXTURES/TRADE NAME PRODUCTS WITH THE LARGEST TRI TOTAL RELEASES AND TRANSFERS, 1987

MIXTURE NAME	TOTAL TRI FORMS REPORTING		TOTAL TRI RELEASES/ TRANSFERS	
	Number	Percent	Pounds	Percent
STYRENE/ETHYL BENZENE MIXTURE	1	0.20	8,572,408	20.59
RECYCLE OIL STYRENE/ETHYL BENZENE MIXTURE	1	0.20	8,567,822	20.58
TREATMENT FACILITY CLOSURE MATERIAL	1	0.20	5,000,000	12.01
UNKNOWN	7	1.38	4,919,213	11.82
NONCHLORINATED SOLVENTS	3	0.59	1,150,250	2.76
SOLVENT BLEND - 4892	1	0.20	625,710	1.50
ACETONE - METHYL ISOBUTYL KETONE - METHYL ETHYL KETONE BLEND	1	0.20	562,002	1.35
WASTE MINERAL SPIRITS	1	0.20	500,000	1.20
SULFURIC ACID H ₂ SO ₄	1	0.20	470,000	1.13
NICKEL COMPOUNDS	3	0.59	357,767	0.86
COPPER	1	0.20	350,500	0.84
STAIN, LACQUER, SEALER, SOLVENT	2	0.39	330,460	0.79
XYLENE (MIXTURE GRADE)	1	0.20	310,460	0.75
METHYLENE CHLORIDE	3	0.59	291,786	0.70
HI AL RAM G - 75.3% ALUMINUM OXIDE	1	0.20	281,000	0.68
COLORED FRIT (LEAD-CADIUM-BARIUM-ZINC)	1	0.20	180,595	0.67
LAMINAR (R) HG DRY FILM PHOTOPOLYMER	1	0.20	252,000	0.61
SODIUM HYDROXIDE	6	1.18	240,350	0.58
ISOPROPYL ALCOHOL	3	0.59	226,025	0.54
1,1,1, TRICHLOROETHANE	1	0.20	217,864	0.52
KEMVAR TOP COAT VARNISH	1	0.20	213,726	0.51
ACETONE	5	0.98	194,787	0.47
CYCLOHEXANE	1	0.20	193,000	0.46
TOLUENE	7	1.38	177,039	0.43
SODIUM HYDROXIDE 50% SOLUTION	1	0.20	160,000	0.38
SUBTOTAL	55	10.81	34,444,764	82.75
TOTAL FOR ALL OTHERS	454	89.19	7,180,495	17.25
GRAND TOTAL	509	100.00	41,625,259	100.00

TABLE 4-7. TRI FACILITIES CLAIMING TRADE SECRETS, 1987

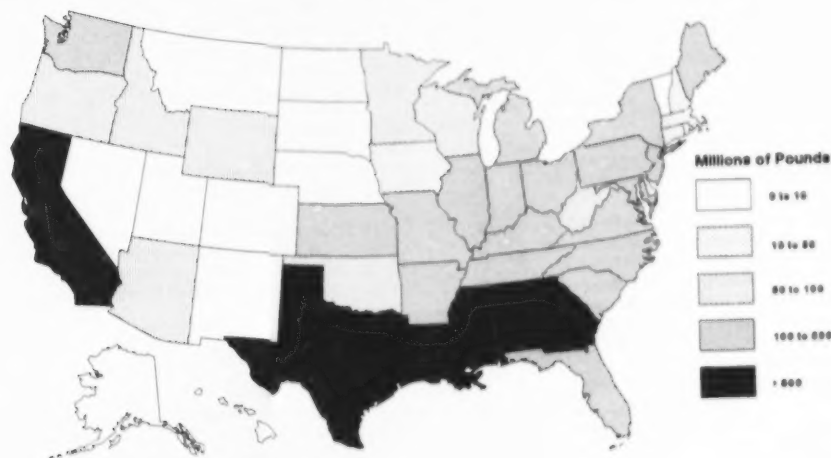
FACILITY NAME	CITY	STATE	TOTAL TRI RELEASE/ TRANSFER	GENERIC CHEMICAL NAME
			Pounds	
HOOVER TREATED WOOD PRODUCTS	PINE BLUFF	AR	250	MINERAL ACID
HOOVER TREATED WOOD PRODUCTS	PINE BLUFF	AR	250	ALDEHYDES
RADIANT COLOR	RICHMOND	CA	250	TRIAZINE
RADIANT COLOR	RICHMOND	CA	250	CYCLIC ANHYDRIDE
RADIANT COLOR	RICHMOND	CA	250	ALDEHYDE
AMERICAL CORPORATION	MYSTIC	CT	0	CATALYST
HANDY & HARMAN	ELK GROVE VILLAGE	IL	0	METAL H
CANDLE CORPORATION OF AMERICA	KANKAKEE	IL	0	GLYCOL
KAL KAN FOODS, INC.	MATTOON	IL	0	INORGANIC ACID
UNISON TRANSFORMER SERVICES, INC.	HENDERSON	KY	252,220	HYDROCARBON DIELECTRIC FLUID COMPONENT
HENDERSON RECOVERY CTRL.				
FIRESTONE SYNTHETIC RUBBER AND LATEX CO.	LAKE CHARLES	LA	249,500	HYDROCARBON CO1
ADAMS PLANT	ADAMS	MA	0	QUENCHING AGENT
UNITED GLAZED PRODUCTS, DIV. OF BURNS & RUSSELL	BALTIMORE	MD	750	UNSATURATED ESTER
LINCOLN PULP & PAPER	LINCOLN	ME	0	MULTI-PROTIC INORGANIC ACID
M. ARGUESO & CO., INC.	MAMARONECK	NY	18,400	BENZENEDICARBOXYLIC ACID
BP CHEMICALS AMERICA, INC.	LIMA	OH	4,300	COMPLEX METAL OXIDE ON AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS AMERICA, INC.	LIMA	OH	750	COMPLEX METAL OXIDE ON AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS AMERICA, INC.	LIMA	OH	41,500	COMPLEX METAL OXIDE ON AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS AMERICA, INC.	LIMA	OH	2,000	COMPLEX METAL OXIDE ON AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS AMERICA, INC.	LIMA	OH	1,750	COMPLEX METAL OXIDE ON AMORPHOUS SILICA SUBSTRATE
TITANIUM BUSINESS OPERATION	MILWAUKIE	OR	110,500	COMPOUND BETA
HOOVER TREATED WOOD PRODUCTS	DILLARD	OR	0	NITROGEN COMPOUND
HOOVER TREATED WOOD PRODUCTS	DILLARD	OR	250	ALDEHYDES
HOOVER TREATED WOOD PRODUCTS	DILLARD	OR	250	MINERAL ACID
JOHNSON MATTHEY	WAYNE	PA	21,250	INORGANIC SALT
HANDY AND HARMAN	EAST PROVIDENCE	RI	3	METAL H
DODGE CHEMICAL COMPANY INC.	PASADENA	TX	48,112	ORGANIC NITRILE
KANEKA TEXAS CORPORATION	PASADENA	TX	380,000	H-5
BASF CORPORATION	FREEPORT	TX	145,800	PHENYL COMPOUND/SOLVENT
FIRESTONE SYNTHETIC RUBBER AND LATEX CO.	ORANGE	TX	671,000	HYDROCARBON (CO1)
BP CHEMICALS - GREEN LAKE	PORT LAVACA	TX	1,000	COMPLEX METAL OXIDE AN AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS - GREEN LAKE	PORT LAVACA	TX	1,000	COMPLEX METAL OXIDE AN AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS - GREEN LAKE	PORT LAVACA	TX	1,000	COMPLEX METAL OXIDE AN AMORPHOUS SILICA SUBSTRATE
BP CHEMICALS - GREEN LAKE	PORT LAVACA	TX	2,750	COMPLEX METAL OXIDE AN AMORPHOUS SILICA SUBSTRATE
HOOVER TREATED WOOD PRODUCTS	MILFORD	VA	250	MINERAL ACID
HOOVER TREATED WOOD PRODUCTS	MILFORD	VA	250	ALDEHYDES
ALLIED SIGNAL INC., TECHNICAL CENTER	PETERSBURG	VA	363,700	HALOGENATED ALKANE
APPLETON PAPERS INC., LOCKS MILL	COMBINED LOCKS	WI	3,370	METAL
3M CARBONLESS	NEKOOSA	WI	27,010	ALIPHATIC HYDROCARBON
3M CARBONLESS	NEKOOSA	WI	18,204	AROMATIC ESTER
WISCONSIN RAPIDS PLANT	WISCONSIN RAPIDS	WI	0	QUENCHING AGENT
APPLETON PAPERS, INC.	APPLETON	WI	17,000	BISPHENOL
TOTAL RELEASES AND TRANSFERS			2,384,119	

reported total releases and transfers in excess of 100,000 pounds. The maximum amount of releases and transfers from an individual facility covered by a trade secret claim was 671,000 pounds of "hydrocarbon (CO1)." This amount accounted for 28 percent of all releases and transfers claimed as trade secrets. Clearly, the small number and amount of releases and transfers subject to trade secrecy claims does not significantly affect the national conclusions presented in this report. Chapter 12 illustrates what information can be discerned from a TRI form notwithstanding a claim of trade secrecy.

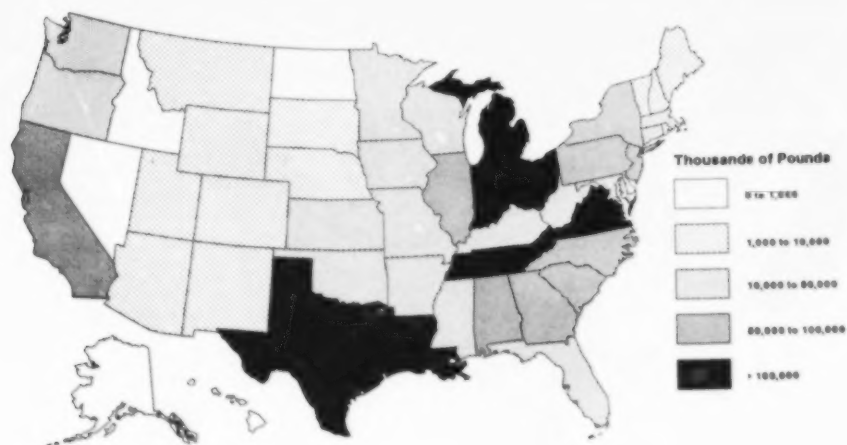
Geographical Distribution of Chemical Class Releases and Transfers

Texas, Louisiana, and Ohio had large releases and transfers of almost all classes of TRI chemicals.

National maps of TRI totals by chemical class reveal various geographical distributions (Maps 4-1 through 4-6, below). Texas, Louisiana, and Ohio had large releases and transfers in most classes. TRI totals for acids/bases/salts were largest in southern states and in California, while other classes were distributed more evenly throughout the country. Alaska was a large source of non-metallic inorganics, while Utah contributed significantly to this class and to metals as well. The chapters that follow present the geographical distributions not only of classes of chemicals, but of selected individual chemicals in each class to highlight the differing patterns of releases



Map 4-1.
Total TRI Releases and Transfers of Acids/Bases/Salts, 1987.

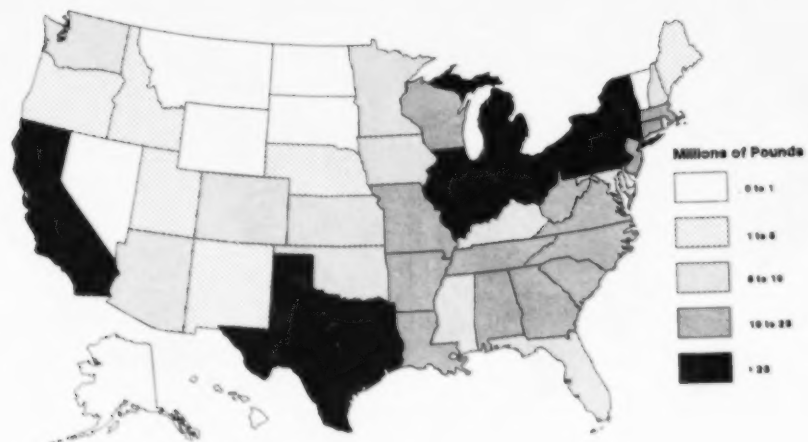


Map 4-2.
Total TRI Releases and Transfers of Organics (non-halogenated), 1987.

Total Releases of Metals and Metal Compounds Reported to TRI, 1987



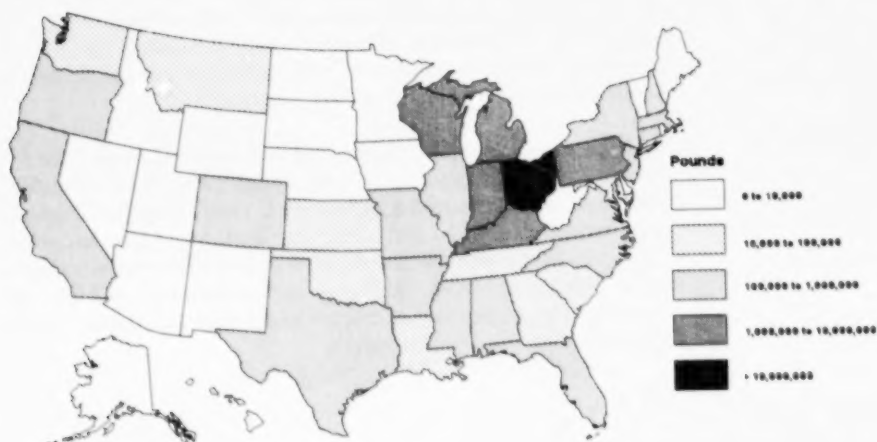
Map 4-3.
Total TRI Releases and Transfers of Metals and Metal Compounds, 1987.



Map 4-4.
Total TRI Releases and Transfers of Halo-Organics, 1987.



Map 4-5.
Total TRI Releases and Transfers of Non-metallic Inorganics, 1987.



Map 4-6.
Total TRI Releases and Transfers of Mixtures, 1987.

Industrial Distribution of Chemical Class Releases

Industries differ considerably in the extent of diversity and chemical makeup of total TRI releases and transfers. For example, Figure 4-7 presents the range in the number of TRI chemicals reported by various industries. The Chemical and Allied Products industry reported the largest number of different chemicals (260), while facilities in the Apparel industry reported only 26 different chemicals.

In most cases, one or two industries dominated the number of TRI forms and the total releases and transfers of a chemical class (Figures 4-9 through 4-13). The Chemical industry dominated both in the number of forms and the total releases and transfers of the acids/bases/salts with 5,418 forms (26 percent of all forms for this class) and 9.8 billion pounds of releases and transfers (63 percent of all releases for this class) (Figure 4-8).

The Chemical industry also released the largest amount of organics with 1.1 billion pounds reported (46 percent of all organic releases). No other industry accounted for as much as ten percent of the releases and transfers of organics (Figure 4-9).

Chapter 4

The Chemical industry dominated the releases and transfers of most chemical classes, except metals and metal compounds, for which the Primary Metals industry was most important.

The Primary Metals industry released the largest amounts of metals and metal compounds—over 1.8 billion pounds or 55 percent of all metals and metal compound releases and transfers (Figure 4-10). The Chemical industry was the only other sector accounting for as much as ten percent of such releases with 687 million pounds (21 percent of metals and metal compound releases and transfers).

With the exception of the Chemical industry, which accounted for 146 million pounds (24 percent) of halo-organic releases and transfers, halo-organic releases and transfers were evenly distributed among many industries (Figure 4-11). This distribution may be due to their widespread use as solvents and degreasers. The releases and transfers by the Fabricated Metals and Transportation industries and the multiple industry groups accounted for more than ten percent of all halo-organic releases and transfers.

The Dominant Role of Sodium Sulfate

Sodium sulfate releases—more than 12 billion pounds—dwarf all others reported to TRI in 1987. Sodium sulfate alone accounts for almost 54 percent of the total releases of all TRI chemicals. Moreover, a single facility in California released 5.2 billion pounds of sodium sulfate—accounting for 23 percent of the releases for all chemicals nationwide. It is likely that sodium sulfate, which is generally considered non-toxic, will no longer be included in the TRI chemical list after this year. The chemical is currently under review by EPA for delisting.

In addition to being produced for commercial distribution, sodium sulfate is also frequently produced as a by-product of many manufacturing processes involving acids and bases, hence its frequent appearance on TRI reporting forms. Sodium sulfate is used in large amounts as a raw material or processing agent in the manufacture of paper, glass, and detergents.

Because this single chemical might obscure overall release patterns, we have indicated when the conclusions about releases would be significantly different if all sodium sulfate releases, or even just the one major release, were excluded. Figure 5-1 (Chapter 5) shows how the environmental distribution of total releases and transfers would have differed if sodium sulfate releases and transfers had not been added to the totals. Furthermore, the acids/bases/salts class would have accounted for 29 percent rather than 69 percent (Figure 4-1) of the total TRI releases and transfers.

The dominant role of sodium sulfate and the report of this one facility is evident from the fact that the State of California now ranks first in total releases amongst the states, but would have ranked ninth if sodium sulfate releases were excluded.

Box 4-D.

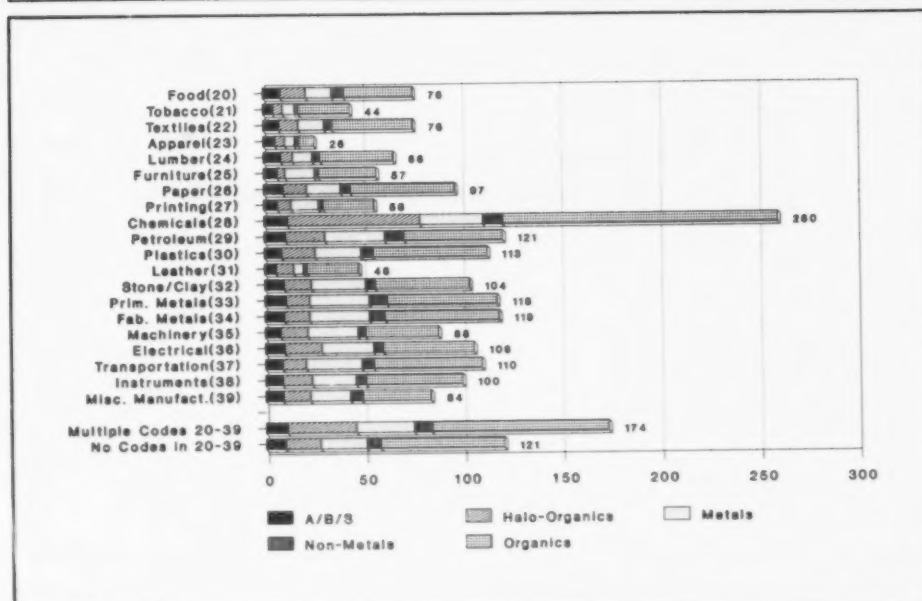


Figure 4-7.
Number of TRI Chemicals Reported by Industry, by Chemical Class, 1987. (A/B/S = Acids/Bases/Salts.)

The Chemical industry and the Primary Metals industry released the largest amounts of non-metallic inorganics (337 million pounds and 119 million pounds, respectively) (Figure 4-12). No other industry reported releases and transfers accounting for more than ten percent of the 649 million pounds of releases and transfers for this class of chemicals.

Three industries—Chemical and Allied Products; Stone, Clay, and Glass Products; and Petroleum Refining—accounted for the three largest releases and transfers of mixtures, reporting approximately 18 million, seven million, and five million pounds, respectively, of the 42 million pound total for all industries (Figure 4-13). Three other industries—Tobacco, Apparel, and Leather—had no forms or releases or transfers for mixtures. The Chemical industry alone accounted for 92 percent of the releases with chemical identity trade secret.

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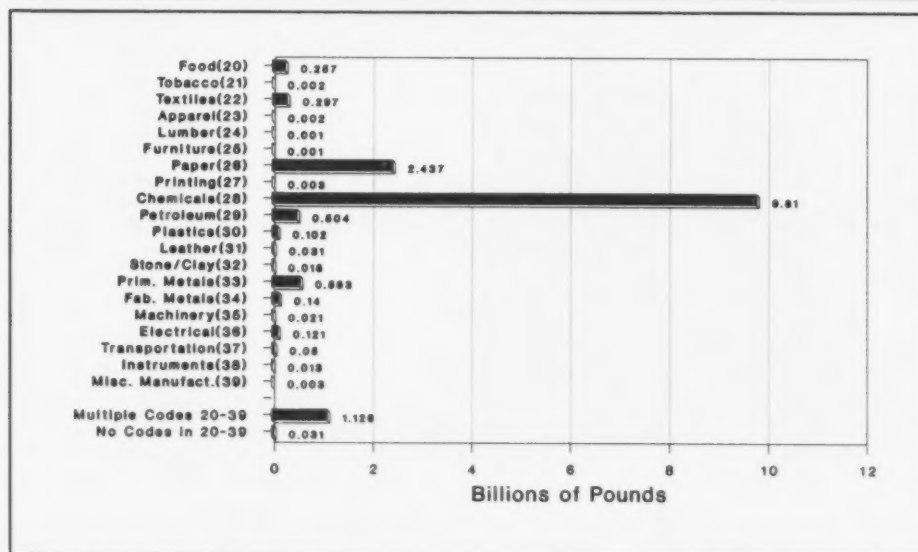


Figure 4-8.
Total TRI Releases and Transfers of Acids/Bases/Salts by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

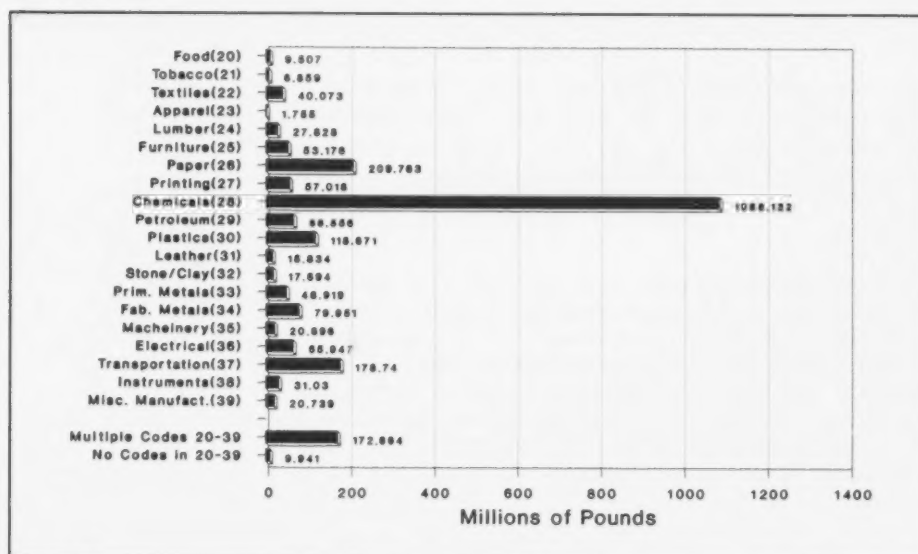


Figure 4-9.
Total TRI Releases and Transfers of Organic Compounds by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

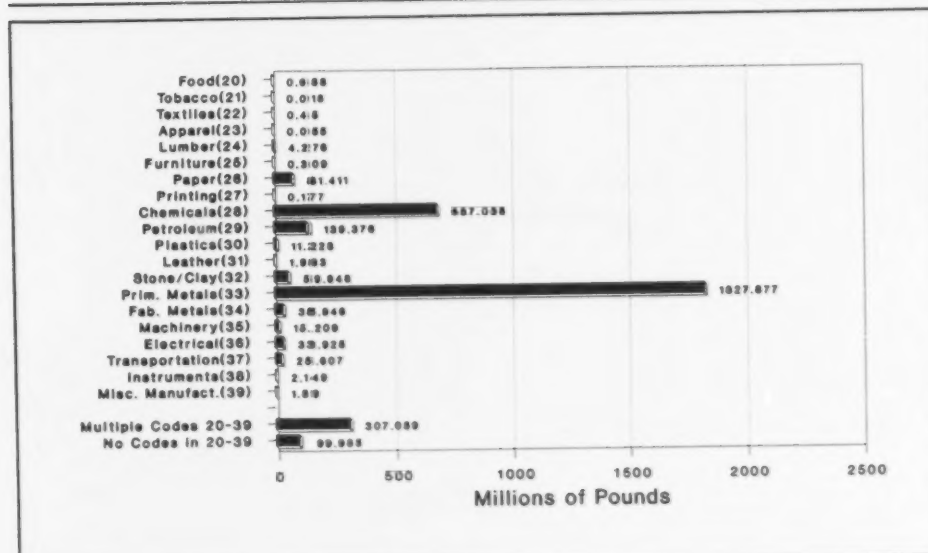


Figure 4-10.
Total TRI Releases and Transfers of Metals and Metal Compounds by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

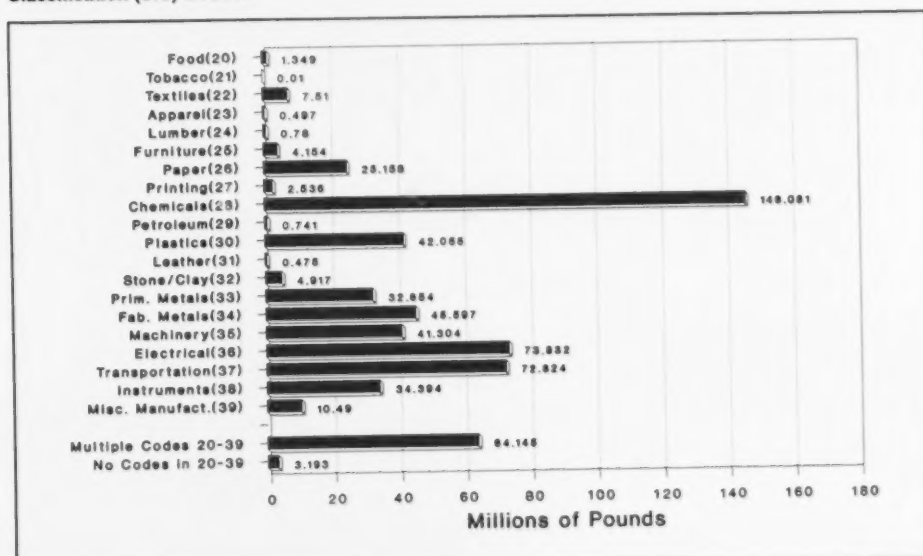


Figure 4-11.
Total TRI Releases and Transfers of Halo-Organics by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

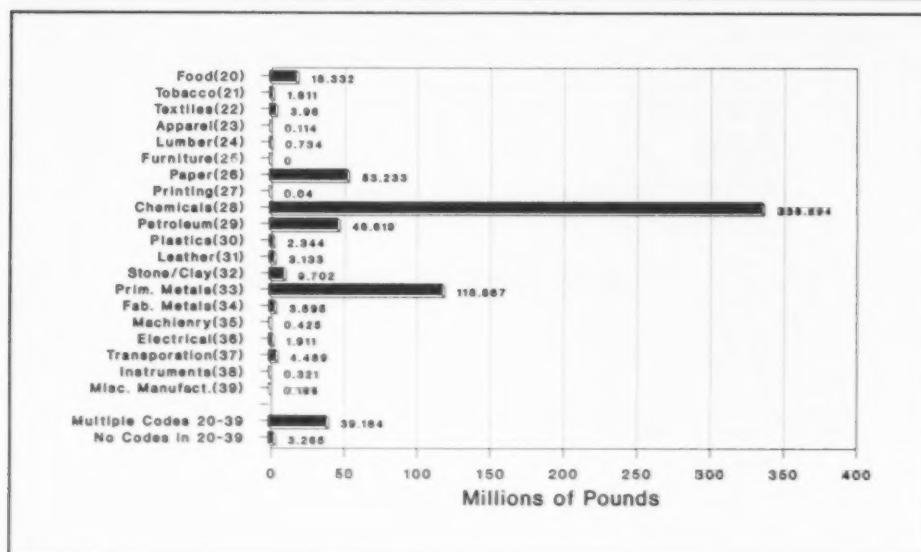


Figure 4-12.
Total TRI Releases and Transfers of Non-Metallic Inorganics by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

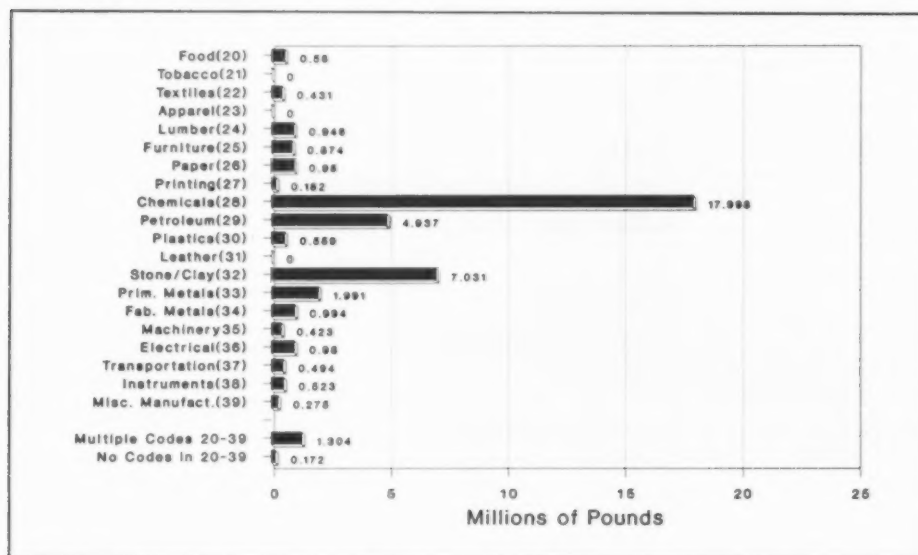


Figure 4-13.
Total TRI Releases and Transfers of Mixtures, 1987. By Standard Industrial Classification (SIC) Codes.

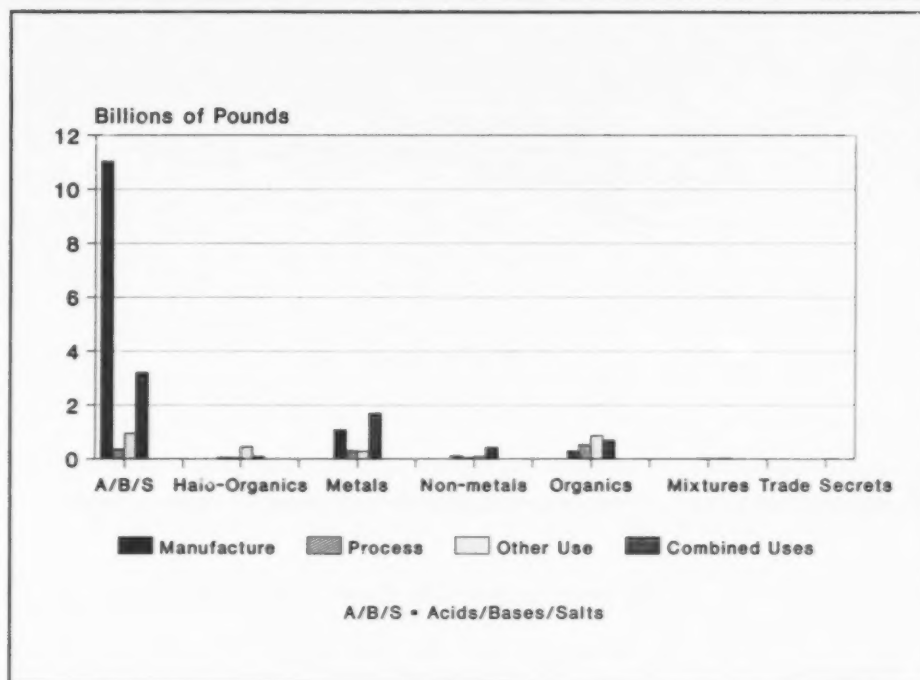


Figure 4-14.
Total TRI Releases and Transfers of Chemical Classes by Industrial Activities and Uses, 1987. (A/B/S = Acids/Bases/Salts.)

Distribution of Chemical Classes by Activity and Use

Releases and transfers of different chemical classes resulted from different industrial activities and uses. For example, facilities that engaged in *manufacture only* dominated the releases of acids/bases/salts and metals and metal compounds (Figure 4-14), while organics and halo-organics were mostly released and transferred by the facilities indicating *other uses only*. The metals and metal compounds and non-metallic inorganics were primarily released and transferred by facilities that indicated a combination of activities and uses.

Manufacturers released and transferred most acids/bases/salts, but facilities identifying other uses released and transferred the most organics and halo-organics.

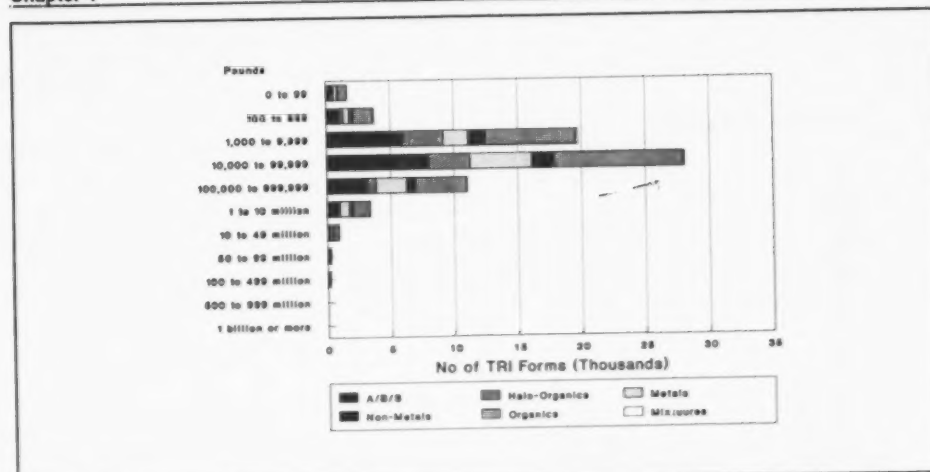


Figure 4-15. TRI Chemical Class Distribution of Maximum Amount On-Site, 1987. (A/B/S = Acids/Bases/Salts.)

The maximum amount on-site during 1987 of most TRI chemicals was between 1,000 and 999,999 pounds.

The maximum amount on-site did not correlate significantly with total releases and transfers of TRI chemicals.

Maximum Amount of Chemicals Kept On-site

In addition to release and transfer data, TRI requires facilities to report the maximum amount of the chemical present on-site during the reporting year. The maximum amount of the chemical on-site is to be reported in 11 pre-specified ranges, ranging from less than 100 pounds to greater than 1 billion pounds. The maximum amount on-site of most chemicals was between 1,000 and 999,999 pounds, with 28,098 forms indicating between 10,000 and 99,999 pounds as the 1987 maximum (Figure 4-15).

The acids/bases/salts class did not dominate the chemicals with the maximum amount on-site, as they did for total releases and transfers (compare Figures 4-1 and 4-15). Organics were kept on-site in the largest quantities. Moreover, the halo-organics represented a much greater percent of the total amount on-site than they did of total releases and transfers. Some of these differences are likely to result from these chemicals being stored on-site in large quantities as reagents, commercial products, or solvents of the processes at the facility, whereas many of the salts are likely to be non-commercial by-products of the reactions or waste treatment processes used, that do not accumulate on-site in large amounts.

THE TRI LIST OF TOXIC CHEMICALS

The question of "what is a toxic chemical?" is a difficult one to answer, since chemicals are so highly variable in their properties, potential routes and amounts of exposure, and fate in the environment or in biological systems. Neither EPA, Congress or the scientific community have ever created a universally-accepted list of "toxic chemicals."

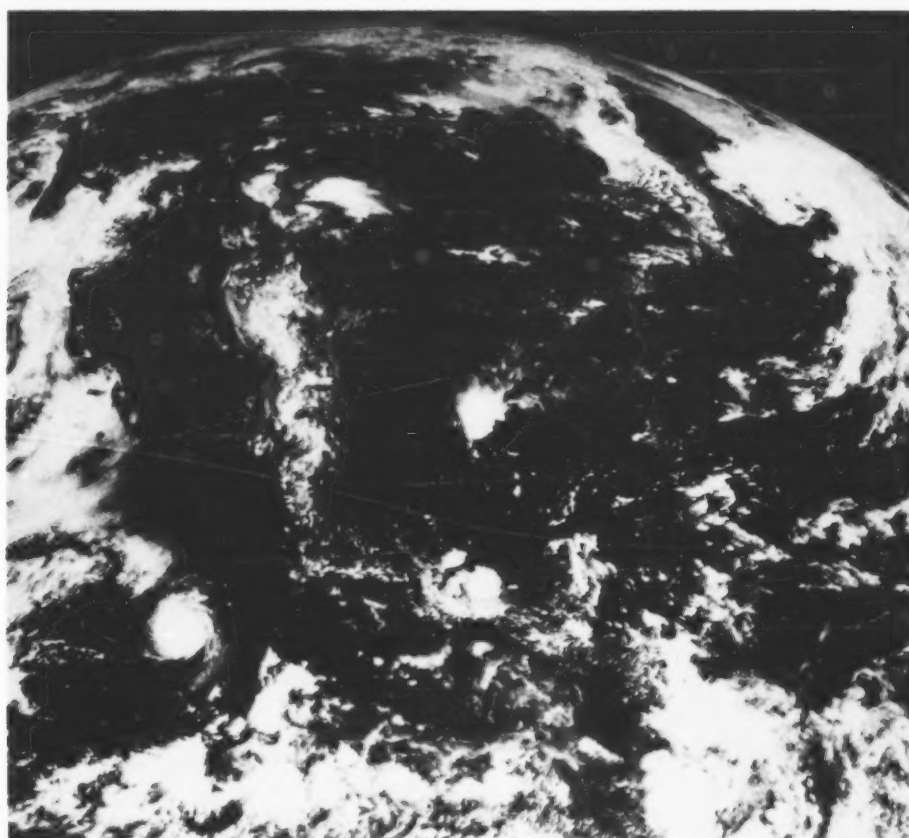
To circumvent the problem of defining toxics, Congress combined the chemical listings from two existing lists in order to create the TRI list of reportable chemicals. These two lists had been in use previously in the States of New Jersey and Maryland.

The original criteria used by New Jersey and Maryland to create their respective lists included information on toxicity, but was also based on considerations of the amount produced or used in the state, regulatory status, presence in the environment, or professional judgement as to potential hazards.

For this reason, the current TRI list covers a very broad spectrum of toxicity concerns, from acutely lethal to only mildly toxic. Some chemicals may not be toxic at all, and will be removed from the TRI list in subsequent reporting years after careful review by EPA. On the other hand, toxic chemicals not currently on the list will be added.

Readers should bear in mind that the amounts of chemicals reported in TRI do not translate directly to concerns about toxic effects.

Box 4-E.



Chapter 5. TRI Environmental Releases and Off-site Transfers

Introduction

Facilities reported to the Toxics Release Inventory (TRI) a total of 22.5 billion pounds, of which 80 percent (18.0 billion pounds of TRI chemicals) were released directly from manufacturing facilities into the air, water, land or underground wells for 1987; an additional 20 percent (4.6 billion pounds) were transferred off-site from the originating facilities to other facilities such as public sewage systems plants or incinerators for treatment or disposal (Figure 5-1).

Eighteen billion pounds of TRI chemicals were released to the environment in 1987 and 4.6 billion pounds were transferred off-site for treatment or disposal.

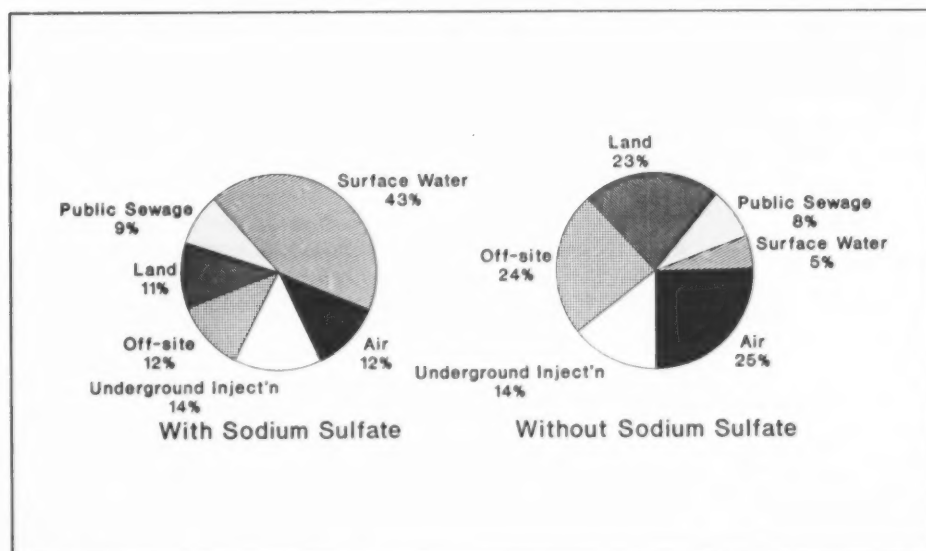


Figure 5-1.
Total 1987 Releases and Transfers of TRI Chemicals, with and without sodium sulfate. Total with sodium sulfate: 22.5 billion pounds. Total without sodium sulfate: 10.4 billion pounds.

TOTAL RELEASES AND TRANSFERS

Throughout this report, the presentations of TRI data refer to "total releases and transfers." While it is useful for comparative purposes to deal with a single sum in this manner, the reader should recognize that this approach does ignore some significant distinctions. "Releases" refer to discharges to the air, water, or land. Facilities determine these numbers after taking into account any reductions in waste achieved by on-site treatment methods. "Transfers" refer to wastes that are sent off-site for treatment or disposal. In many cases, these transferred wastes will be significantly reduced by treatment methods before any ultimate releases to the environment. Such additional off-site treatment is not reflected in the TRI data.

Even within the category of releases, there are further distinctions to bear in mind. Certain land releases, for example, are placed in disposal facilities which are designed and permitted to receive toxic materials. These wastes are therefore managed to significantly reduce potential for further distribution to the environment. Releases to the air and water, on the other hand, are not subject to further containment or control.

Box 5-A.

Sodium sulfate accounted for more than half of all releases and transfers in 1987.

All told, TRI encompassed 22.5 billion pounds of releases and transfers in 1987 (Box 5-A). However, a single chemical — sodium sulfate — accounted for more than half of this amount, thus greatly affecting the overall patterns of releases and transfers presented in this report (Figure 5-1). The influence of this one chemical is discussed throughout this chapter, and throughout this report, in order to lend perspective to the role it plays (Box 5-B).

TRI data show many patterns of chemical releases and transfers across the nation. This chapter discusses where releases and transfers originated, which types of industries accounted for the greatest portion, and what specific chemicals were involved in different types of releases and transfers.

The data presented here are not, however, direct indicators of exposure or of environmental risk posed by the TRI chemicals. Many factors combine to determine how much of a risk, if any, is posed by particular releases and transfers of TRI chemicals (Box 5-C).

THE IMPACT OF SODIUM SULFATE

Sodium sulfate releases and transfers of more than 12 billion pounds dwarf all other chemicals reported to TRI in 1987. Sodium sulfate alone accounts for 54 percent of total releases and transfers for all TRI chemicals (Figure 5-1). Moreover, a single facility in California released 5.2 billion pounds of sodium sulfate, accounting for 23 percent of total national releases and transfers.

EPA has been petitioned to remove sodium sulfate from the list of TRI chemicals requiring reporting due to an apparent absence of significant toxicity concerns for this chemical. When the petition is granted — as of this writing, EPA has formally recommended removing sodium sulfate from the TRI list — the portrait of TRI releases and transfers will change dramatically.

For example, the geographical distribution for 1987 would have been rather different without sodium sulfate: California, which in 1987 had the largest amount of TRI chemical wastes, would have ranked ninth in the nation without sodium sulfate.

The environmental distribution of TRI releases and transfers would have also shown an altered pattern. Discharges to surface water, which ranked first of all types of releases and transfers (75 percent of the total sodium sulfate released or transferred in 1987 went to surface water), would have been the smallest release type. As shown in Figure 5-1, air emissions, which did not appear as significant compared to the large releases and transfers of sodium sulfate to surface water and public sewage systems, would have been the leading type of release, with one quarter of the total TRI releases and transfers.

The acids/bases/salts class of chemicals, which in 1987 accounted for 69 percent of total TRI releases and transfers, would drop to only 33 percent without sodium sulfate, while the proportion of organics and metals/metal compounds classes would increase. Finally, the total amount of TRI releases and transfers would be cut by more than half.

Box 5-B.

Where TRI Chemical Releases and Transfers Originated

Geographical Distribution

The 5.8 billion pounds of releases and transfers from California dwarfed those of any other state, accounting for 26 percent of the TRI total for the nation (Table 5-1). However, the great majority of California's total was due to sodium sulfate releases from a single facility in the state which discharged 3.7 billion pounds of this chemical to surface water, and an additional 1.5 billion pounds by underground injection. Without this one chemical, California's TRI data (and the national data) would appear very different (Box 5-B).

California and states in the Gulf Coast, Mid-Atlantic, and Great Lakes regions had the largest TRI releases and transfers.

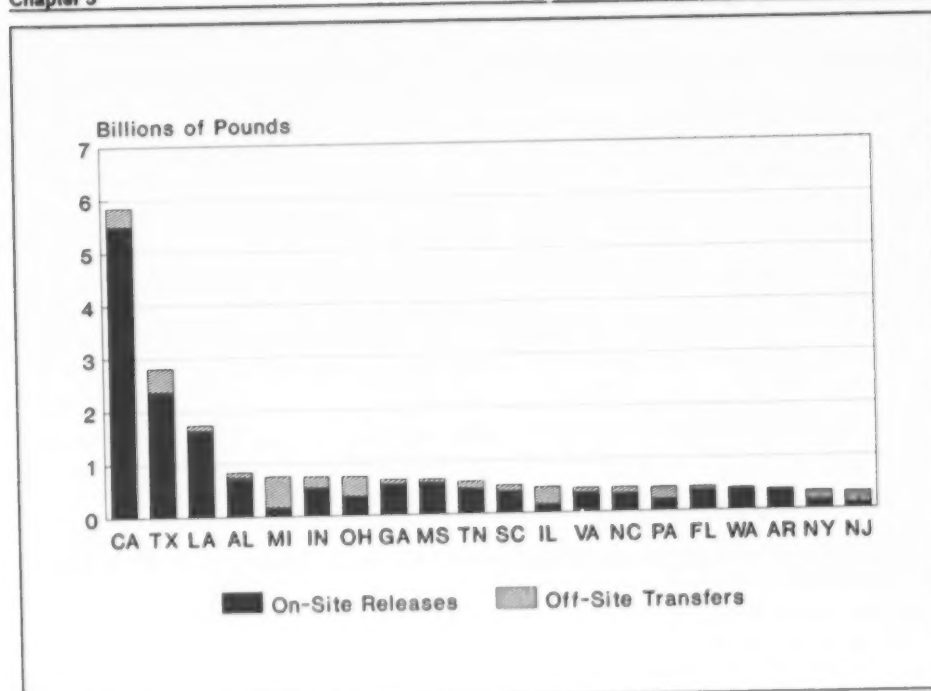
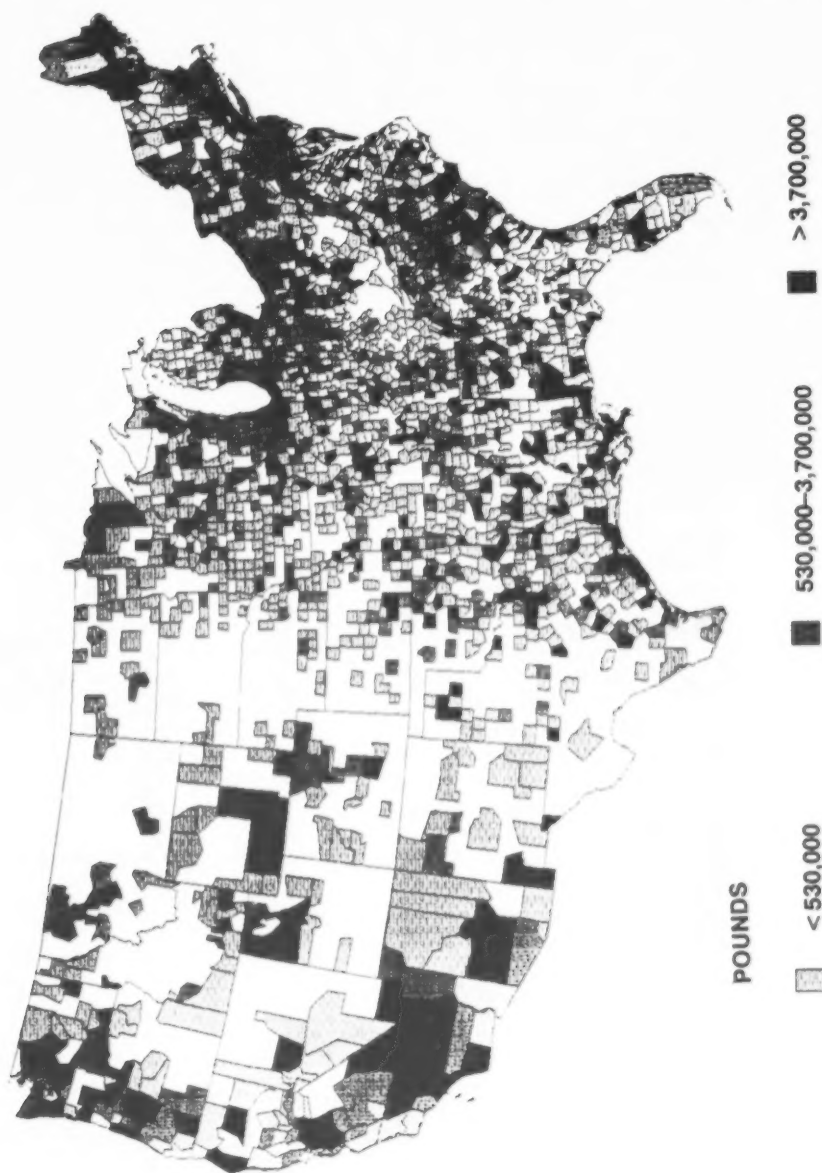


Figure 5-2.
The 20 States with the Largest Total TRI Releases and Transfers, 1987.

Eleven states had total TRI releases and transfers of over 500 million pounds each.

States in the Gulf Coast, Mid-Atlantic, and Great Lakes regions also had fairly large sums of TRI releases and transfers, while the smallest amounts were generated in the Rocky Mountain and Great Plains regions of the country (Map 5-1). Tables 5-1 and 5-2 display a complete account of all states. The 20 states with the largest TRI totals are shown in Figure 5-2. Eleven of the states had totals in excess of 500 million pounds and accounted for over two thirds (15.8 billion pounds) of TRI total releases and transfers.

The two states with the greatest total of TRI releases and transfers—California and Texas—also ranked high in terms of total numbers of reporting facilities; 1st and 5th, respectively (see Chapter 3, Table 3-1 and Figure 3-2). In contrast, Louisiana had the third largest total releases and transfers, but ranked 26th of all states based on number of TRI facilities.



Map 5-1. Total Releases and Transfers of TRI Chemicals Reported Nationwide, by County, 1987.

TABLE 5-1. TRI FACILITIES, FORMS, AND TOTAL
RELEASES /TRANSFERS BY STATE, 1987

STATE	TRI FACILITIES	TRI FORMS	TOTAL TRI RELEASES/ TRANSFERS	
	Number	Number	Pounds	Percent
Alabama	355	1,508	827,064,312	3.67
Alaska	7	53	36,944,052	0.16
American Samoa	2	5	72,000	0.00
Arizona	156	545	126,071,984	0.56
Arkansas	293	988	374,781,464	1.66
California	1,662	5,830	5,839,808,374	25.93
Colorado	172	540	35,330,997	0.16
Connecticut	383	1,412	86,374,380	0.38
Delaware	53	263	58,818,708	0.26
Florida	419	1,331	434,685,722	1.93
Georgia	636	2,185	661,730,868	2.94
Hawaii	33	122	5,063,453	0.02
Idaho	52	163	73,411,988	0.33
Illinois	1,185	4,314	468,816,984	2.08
Indiana	720	2,790	731,729,004	3.25
Iowa	310	1,012	71,583,169	0.32
Kansas	184	742	183,390,807	0.81
Kentucky	298	1,353	250,942,142	1.11
Louisiana	259	1,818	1,725,933,233	7.66
Maine	83	360	219,560,564	0.97
Maryland	191	720	195,248,259	0.87
Massachusetts	560	1,852	104,826,800	0.47
Michigan	758	3,339	742,716,029	3.30
Minnesota	301	1,198	141,498,325	0.63
Mississippi	247	876	656,085,795	2.91
Missouri	503	1,902	292,426,658	1.30
Montana	27	148	38,437,649	0.17
Nebraska	139	424	21,149,589	0.09
Nevada	33	91	11,735,250	0.05
New Hampshire	129	435	65,131,279	0.29
New Jersey	875	3,280	308,585,011	1.37
New Mexico	32	119	22,528,013	0.10
New York	765	2,836	326,074,780	1.45
North Carolina	820	2,792	441,345,879	1.96
North Dakota	28	72	2,803,582	0.01
Ohio	1,261	5,116	723,893,016	3.21
Oklahoma	193	686	129,781,423	0.58
Oregon	217	705	120,604,568	0.54
Pennsylvania	1,027	3,989	437,634,494	1.94
Puerto Rico	172	572	42,927,540	0.19
Rhode Island	166	472	26,622,622	0.12
South Carolina	394	1,694	518,127,600	2.30
South Dakota	37	75	3,518,226	0.02
Tennessee	503	1,889	602,148,025	2.67
Texas	999	5,381	2,799,768,533	12.43
Utah	102	393	249,743,154	1.11
Vermont	52	158	4,889,666	0.02
Virgin Islands	1	24	7,424,628	0.03
Virginia	399	1,450	444,049,924	1.97
Washington	306	1,091	407,078,587	1.81
West Virginia	107	672	170,571,053	0.76
Wisconsin	645	2,239	184,957,138	0.82
Wyoming	27	128	62,596,791	0.28
TOTAL	19,278	74,152	22,519,044,091	100.00

TRI DATA AND EXPOSURE

The 18.0 billion pounds of TRI releases and 4.6 billion pounds of transfers are not an indicator of human or environmental exposure to these chemicals. Several factors should be kept in mind when considering the impact of TRI releases and transfers.

First, environmental releases do not always result in exposure. Releases to landfills or to underground injection are intended to isolate these wastes, and result in zero or low exposure unless there is an unexpected failure of the disposal technique.

Even chemical releases that are not isolated in this manner require careful interpretation. TRI reveals that 2.7 billion pounds of TRI chemicals were released directly to the air, and 9.6 billion pounds to surface water in 1987. These releases cannot be equated directly to exposure, since each chemical in each individual release circumstance undergoes different transformations after release. Dilution may render exposure concentrations so small as to be of no concern. Gaseous emissions may be chemically transformed to harmless byproducts, or acidic wastewater discharges may be effectively neutralized by the receiving body of water. On the other hand, some environmental transformations lead to byproducts of even greater concern than the original releases. Each release scenario has its own unique characteristics.

TRI chemicals were also transferred to public sewage treatment plants and other off-site facilities, where they may undergo treatment (which can destroy or isolate a potentially toxic chemical) prior to ultimate disposal. The transfers also shift the location of materials, so that TRI releases generated in, say, New Jersey, may ultimately be sent to Ohio for treatment and/or disposal. A knowledge of the ultimate fate of these materials would be needed for any meaningful interpretation of potential risks.

Lastly, TRI chemicals cover a broad spectrum of toxicity concerns and total release or transfer amounts only give part of the story — a small release of a highly toxic chemical might be of much greater concern than a large release of a low-toxicity substance.

In all cases, more information is needed to assess potential concerns than is provided by TRI data alone. TRI can only serve as an indicator of toxic chemical releases and transfers that may warrant additional examination.

Box 5-C.

TABLE 5-2. TRI RELEASES AND TRANSFERS BY TYPE BY STATE, 1987
(Percentages are of total releases and transfers for the state)

STATE	TOTAL TRI AIR EMISSIONS		TOTAL TRI SURFACE WATER DISCHARGES		TOTAL TRI TRANSFERS TO PUBLIC SEWAGE	
	Pounds	Percent	Pounds	Percent	Pounds	Percent
Alabama	98,339,784	11.9	533,895,407	64.6	32,713,211	4.0
Alaska	31,707,083	85.8	5,221,865	14.1	35	0.0
American Samoa	56,250	78.1	15,750	21.9	0	0.0
Arizona	16,565,691	13.1	3,000	0.0	9,236,876	7.3
Arkansas	54,559,906	14.6	171,220,328	45.7	4,325,937	1.2
California	82,708,429	1.4	3,834,809,964	65.7	246,101,586	4.2
Colorado	11,010,395	31.2	3,325,009	9.4	3,125,396	8.8
Connecticut	26,078,031	30.2	25,225,312	29.2	9,544,587	11.1
Delaware	6,036,385	10.3	29,852,685	50.8	16,375,820	27.8
Florida	50,196,070	11.5	107,593,997	24.8	39,468,550	9.1
Georgia	93,586,285	14.1	473,506,462	71.6	47,093,822	7.1
Hawaii	1,064,495	21.0	2,542,000	50.2	973,250	19.2
Idaho	4,176,707	5.7	50,737,549	69.1	3,250,118	4.4
Illinois	99,226,761	21.2	33,437,606	7.1	199,165,360	42.5
Indiana	112,870,299	15.4	105,987,418	14.5	95,899,156	13.1
Iowa	39,238,921	54.8	15,335,547	21.4	10,090,895	14.1
Kansas	24,738,143	13.5	7,578,737	4.1	6,647,139	3.6
Kentucky	51,666,181	20.6	76,869,713	30.6	13,649,364	5.4
Louisiana	138,254,193	8.0	775,836,211	45.0	1,334,641	0.1
Maine	14,607,382	6.7	195,803,966	89.2	5,071,706	2.3
Maryland	20,234,753	10.4	111,795,540	57.3	47,863,355	24.5
Massachusetts	30,061,360	28.7	2,116,295	2.0	36,142,507	34.5
Michigan	116,359,932	15.7	38,127,898	5.1	38,245,470	5.1
Minnesota	42,095,160	29.7	15,826,354	11.2	70,020,634	49.5
Mississippi	57,285,976	8.7	473,882,098	72.2	9,125,709	1.4
Missouri	50,623,710	17.3	36,406,436	12.4	112,489,998	38.5
Montana	5,255,856	13.7	791,946	2.1	28,109	0.1
Nebraska	14,403,622	68.1	2,754,398	13.0	1,213,294	5.7
Nevada	742,389	6.3	0	0.0	33,814	0.3
New Hampshire	12,983,935	19.9	42,428,961	65.1	2,802,094	4.3
New Jersey	41,983,116	13.6	55,063,498	17.8	123,413,118	40.0
New Mexico	3,831,726	17.0	9,057	0.0	738,719	3.3
New York	89,399,757	27.4	56,110,261	17.2	65,294,934	20.0
North Carolina	94,568,576	21.4	217,090,591	49.2	54,537,779	12.4
North Dakota	935,275	33.4	393,600	14.0	94,217	3.4
Ohio	172,685,650	23.9	68,219,055	9.4	131,193,018	18.1
Oklahoma	36,445,117	28.1	65,792,624	50.7	1,692,971	1.3
Oregon	20,941,392	17.4	63,362,600	52.5	13,900,170	11.5
Pennsylvania	87,547,598	20.0	61,901,577	14.1	39,815,049	9.1
Puerto Rico	12,867,913	30.0	1,676,734	3.9	23,060,390	53.7
Rhode Island	5,927,841	22.3	13,187,892	49.5	2,998,055	11.3
South Carolina	64,215,277	12.4	340,939,102	65.8	51,090,961	9.9
South Dakota	2,441,359	69.4	3,698	0.1	620,208	17.6
Tennessee	135,010,665	22.4	196,399,204	32.6	97,149,025	16.1
Texas	238,817,765	8.5	659,657,602	23.6	154,293,072	5.5
Utah	77,327,036	31.0	133,749	0.1	2,032,004	0.8
Vermont	1,379,661	28.2	1,113,799	22.8	298,037	6.1
Virgin Islands	2,033,873	27.4	5,303,250	71.4	0	0.0
Virginia	132,436,076	29.8	225,383,321	50.8	55,690,097	12.5
Washington	40,637,496	10.0	303,684,767	74.6	4,061,980	1.0
West Virginia	35,564,455	20.9	87,295,714	51.2	5,179,381	3.0
Wisconsin	48,656,361	26.3	16,563,741	9.0	46,313,952	25.0
Wyoming	3,154,641	5.0	3,460,037	5.5	17,800	0.0
TOTAL	2,655,542,710	11.8	9,615,673,925	42.7	1,935,517,370	8.6

TRI Total Releases and Transfers

TABLE 5-2. (Continued)

STATE	TOTAL TRI ON-SITE LAND RELEASES		TOTAL TRI UNDERGROUND INJECTION		TOTAL TRI OFF-SITE TRANSFERS		TOTAL TRI RELEASES/ TRANSFERS	TOTAL TRI RELEASES/ TRANSFERS
	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Rank
Alabama	98,091,692	11.9	1,443,591	0.2	62,580,627	7.6	827,064,312	4
Alaska	14,930	0.0	0	0.0	139	0.0	36,944,052	42
American Samoa	0	0.0	0	0.0	0	0.0	72,000	53
Arizona	97,102,865	77.0	0	0.0	3,163,551	2.5	126,071,984	31
Arkansas	108,534,294	29.0	13,016,449	3.5	23,124,550	6.2	374,781,464	18
California	47,693,392	0.8	1,530,850,645	26.2	97,644,358	1.7	5,839,808,374	1
Colorado	12,547,494	35.5	1,170	0.0	5,321,533	15.1	35,330,997	43
Connecticut	1,848,676	2.1	0	0.0	23,677,774	27.4	86,374,380	34
Delaware	2,565,876	4.4	250	0.0	3,987,692	6.8	58,818,708	39
Florida	190,827,201	43.9	29,437,389	6.8	17,162,515	3.9	434,685,722	16
Georgia	14,969,473	2.3	19,500	0.0	32,555,326	4.9	661,730,868	8
Hawaii	237,342	4.7	216,140	4.3	30,226	0.6	5,063,453	49
Idaho	14,988,307	20.4	0	0.0	259,307	0.4	73,411,988	35
Illinois	11,209,153	2.4	14,221,970	3.0	111,556,134	23.8	468,816,984	12
Indiana	246,523,580	33.7	63,356,466	8.7	107,092,085	14.6	731,729,004	6
Iowa	768,722	1.1	0	0.0	6,149,084	8.6	71,583,169	36
Kansas	1,058,669	0.6	91,067,410	49.7	52,300,709	28.5	183,390,807	27
Kentucky	4,028,637	1.6	25,000,250	10.0	79,727,997	31.8	250,942,142	22
Louisiana	154,894,837	9.0	553,820,180	32.1	101,793,171	5.9	1,725,933,233	3
Maine	2,037,139	0.9	0	0.0	2,040,371	0.9	219,560,564	24
Maryland	4,318,725	2.2	750	0.0	11,035,136	5.7	195,248,259	25
Massachusetts	3,575,212	3.4	250	0.0	32,931,176	31.4	104,826,800	33
Michigan	3,979,327	0.5	6,472,752	0.9	539,530,650	72.6	742,716,029	5
Minnesota	1,722,105	1.2	250	0.0	11,833,822	8.4	141,498,325	29
Mississippi	15,252,731	2.3	46,433,140	7.1	54,106,141	8.2	656,085,795	9
Missouri	56,439,000	19.3	1,001,450	0.3	35,466,064	12.1	292,426,658	21
Montana	32,223,598	83.8	0	0.0	138,140	0.4	38,437,649	41
Nebraska	349,910	1.7	0	0.0	2,428,365	11.5	21,149,589	46
Nevada	10,817,492	92.2	0	0.0	141,555	1.2	11,735,250	47
New Hampshire	666,529	1.0	0	0.0	6,249,760	9.6	65,131,279	37
New Jersey	5,312,503	1.7	780	0.0	82,811,996	26.8	308,585,011	20
New Mexico	17,307,456	76.8	0	0.0	641,055	2.8	22,528,013	45
New York	17,598,716	5.4	500	0.0	97,670,612	30.0	326,074,780	19
North Carolina	30,157,949	6.8	250	0.0	44,990,734	10.2	441,345,879	14
North Dakota	1,100,500	39.3	0	0.0	279,990	10.0	2,803,582	52
Ohio	47,664,590	6.6	71,850,645	9.9	232,280,058	32.1	723,893,016	7
Oklahoma	2,482,881	1.9	7,171,133	5.5	16,196,697	12.5	129,781,423	30
Oregon	13,998,763	11.6	0	0.0	8,401,643	7.0	120,604,568	32
Pennsylvania	70,957,429	16.2	74,000	0.0	177,338,841	40.5	437,634,494	15
Puerto Rico	184,150	0.4	988	0.0	5,137,365	12.0	42,927,540	40
Rhode Island	69,009	0.3	0	0.0	4,439,825	16.7	26,622,622	44
South Carolina	8,994,959	1.7	750	0.0	52,886,551	10.2	518,127,800	11
South Dakota	9	0.0	0	0.0	452,952	12.9	3,518,226	51
Tennessee	20,550,544	3.4	124,406,900	20.7	28,631,687	4.8	602,148,025	10
Texas	835,087,965	29.8	630,223,666	22.5	281,688,463	10.1	2,799,768,533	2
Utah	165,467,430	66.3	3	0.0	4,782,932	1.9	249,743,154	23
Vermont	168,696	3.5	0	0.0	1,929,473	39.5	4,889,666	50
Virgin Islands	87,505	1.2	0	0.0	0	0.0	7,424,628	48
Virginia	6,949,712	1.6	250	0.0	23,590,468	5.3	444,049,924	13
Washington	25,105,014	6.2	500	0.0	33,588,830	8.3	407,078,587	17
West Virginia	11,638,215	6.8	1,719,219	1.0	29,174,069	17.1	170,571,053	28
Wisconsin	7,535,521	4.1	1,500	0.0	65,886,063	35.6	184,957,138	26
Wyoming	24,183,539	38.6	30,651,671	49.0	1,129,103	1.8	62,596,791	38
TOTAL	2,451,889,964	10.9	3,242,462,757	14.4	2,617,957,365	11.6	22,519,044,091	

Chapter 5

Twenty-five counties accounted for 52 percent of all TRI releases and transfers.

The information in TRI allows analyses at many different levels of geographical detail. The 25 counties where the largest total releases and transfers were reported (Table 5-3) provides additional detail of where, within states, TRI releases and transfers occurred during 1987 (Map 5-1). San Bernardino county in California contains the facility with the large sodium sulfate release and, not surprisingly, exceeds by far the TRI totals of any other county in the nation. One other California county—Los Angeles County—is also on the list. Texas and Louisiana each have six counties on the list. Together, these 25 counties account for 52 percent of all TRI releases and transfers in the nation.

TABLE 5-3. THE 25 COUNTIES WITH THE LARGEST TOTAL TRI RELEASES AND TRANSFERS

COUNTY	STATE	TOTAL TRI RELEASES/ TRANSFERS Pounds	PERCENT OF TOTAL RELEASES AND TRANSFERS IN THE STATE
SAN BERNARDINO	CA	5,243,062,330	89.78
HARRIS	TX	612,608,053	21.88
CALHOUN	TX	581,051,418	20.75
WAYNE	MI	512,936,086	69.06
HARRISON	MS	423,584,099	64.56
BRAZORIA	TX	404,783,709	14.46
ST JAMES	LA	349,539,065	20.25
MILAM	TX	329,113,150	11.76
JEFFERSON	TX	309,581,341	11.06
ST CHARLES	LA	284,420,548	16.48
LOS ANGELES	CA	282,111,744	4.83
MOBILE	AL	245,504,063	29.68
JEFFERSON	LA	222,520,676	12.89
CHARLESTON	SC	210,956,381	40.72
ASCENSION	LA	203,735,851	11.80
LAKE	IN	199,307,629	27.24
SALT LAKE	UT	164,454,513	65.85
COOK	IL	161,093,780	34.36
COWLITZ	WA	156,756,742	36.51
EAST BATON ROUGE	LA	156,151,040	9.05
ANNE ARUNDEL	MD	140,449,676	71.93
CALCASIEU	LA	139,155,388	8.06
WARREN	VA	135,164,100	30.44
SALINE	AR	134,087,064	35.78
GALVESTON	TX	133,993,080	4.79
SUBTOTAL		11,736,121,526	
% OF GRAND TOTAL		52.12	
TOTAL FOR ALL OTHERS		10,782,922,565	
GRAND TOTAL		22,519,044,091	

Environmental Distribution of Releases and Transfers

Larger amounts of TRI chemicals were released to water than were discharged to any other environmental media or transferred off-site in 1987 (Figure 5-1, above). Almost half the total amount of TRI releases and transfers (9.6 billion pounds) was discharged to surface water. Facilities disposed of 3.2 billion pounds (14 percent of the TRI total) into underground wells. Air received the next highest sum, with emissions totalling 2.7 billion pounds (12 percent), and facilities disposed of 2.5 billion pounds (11 percent) on land. (See Box 5-C.)

In addition to environmental releases, 1.9 billion pounds of TRI chemicals (9 percent of the TRI total) were discharged to public sewage systems and another 2.6 billion pounds (12 percent) were transferred to other off-site facilities.

The distribution of releases and transfers for 1987 would appear quite different if sodium sulfate were not added in (Box 5-B). Sodium sulfate played a singular role in the distribution of the TRI data, accounting for 50 percent or more of discharges to surface water, underground injection, and public sewage systems (Chapters 7, 8).

For some types of TRI releases, individual states played a large role as well. Facilities in California, Texas and Louisiana discharged more TRI chemicals to water than any other state; overall, these 3 states accounted for 55 percent of total TRI surface water releases. Texas facilities emitted more TRI chemicals to the air (239 million pounds) than any other state, releasing nine percent of total TRI air emissions nationwide, and released more TRI chemicals to land (835 million pounds) than any other state, representing 34 percent of total land releases.

Subsequent chapters present details of the releases to each segment of the environment and for off-site transfers. Chapters 6, 7, and 8 contain analyses of releases to air, water, and land; Chapter 7 also contains data on off-site transfers to public sewage treatment plants. Chapter 9 examines off-site transfers (other than to public sewage systems), and Chapter 10 examines TRI data on waste treatment. The remainder of this chapter focuses on industrial and chemical overviews of the TRI data.

Over 40 percent of TRI releases and transfers were discharged to surface water, 14 percent to underground wells, 12 percent to air, 11 percent to land.

Facilities transferred 9 percent of the TRI total to public sewage plants and 12 percent to other off-site facilities.

Industrial Releases and Off-site Transfers of TRI Chemicals

Fifty-four percent of TRI releases and transfers were from the Chemical industry.

Industrial Distribution

The Chemical and Allied Products industry generated more TRI releases and transfers than any other industry in 1987 with a total of 12.1 billion pounds or 54 percent of the TRI total for all industries (Table 5-4). Only two other industries reported TRI totals of more than one billion pounds: Paper and Primary Metals. Together, these three industries generated 78 percent of the total reported TRI releases and transfers. (See Chapter 2 and Appendix C for more information about which industries must report under TRI).

In contrast, the five industries with the smallest TRI releases and transfers together accounted for less than one percent of the TRI total. The Apparel industry reported the smallest total, followed by Tobacco Manufacturing, Lumber Products, Miscellaneous Manufacturing, and Leather Products industries.

TABLE 5-4. TRI FACILITIES, FORMS AND TOTAL RELEASES BY INDUSTRY, 1987

TOTAL TRI RELEASE/ TRANSFER	SIC	INDUSTRY	TRI FACILITIES		TRI FORMS		TOTAL TRI RELEASES/ TRANSFERS			
			Rank	CODE	Number	Percent	Number	Percent	Pounds	Percent
10	20	Food Products			1,576	8.18	3,441	4.64	287,011,684	1.2
21	21	Tobacco Manufacturers			24	0.12	80	0.11	10,461,881	0.05
6	22	Textile Mill Products			469	2.43	1,208	1.63	349,911,142	1.55
22	23	Apparel			37	0.19	65	0.09	4,770,371	0.02
20	24	Lumber and Wood Products			644	3.34	1,746	2.35	35,960,744	0.16
17	25	Furniture and Fixtures			332	1.72	1,349	1.82	59,715,475	0.27
2	26	Paper Products			663	3.44	2,650	3.57	2,807,409,484	12.47
16	27	Printing, Publishing			287	1.49	601	0.81	62,936,388	0.28
1	28	Chemical Products			3,849	19.97	21,219	28.62	12,088,829,671	53.68
5	29	Petroleum Refining			343	1.78	3,225	4.35	762,361,469	3.39
11	30	Rubber and Plastic Products			1,125	5.84	2,770	3.74	277,096,613	1.23
18	31	Leather Products			117	0.61	424	0.57	52,087,328	0.23
13	32	Stone, Clay, Glass Products			629	3.26	1,609	2.17	116,968,737	0.52
3	33	Primary Metals			1,305	6.77	5,587	7.53	2,593,238,041	11.52
8	34	Fabricated Metals			2,393	12.41	8,039	10.84	306,289,006	1.36
14	35	Machinery, except Electrical			787	4.08	2,242	3.02	99,091,372	0.44
9	36	Electric and Electronic Equip.			1,426	7.40	5,163	6.96	297,117,232	1.32
7	37	Transportation Equipment			908	4.71	4,483	6.05	332,397,007	1.48
15	38	Measuring, Photographic Goods			306	1.59	1,032	1.39	81,141,337	0.36
19	39	Misc. Manufacturing			337	1.75	911	1.23	36,324,473	0.16
4	Multiple SIC codes in 20 - 39				1,317	6.83	5,065	6.83	1,709,984,714	7.59
12	No SIC codes in 20 - 39				404	2.10	1,243	1.68	147,939,922	0.66
TOTAL					19,278	100.00	74,152	100.00	22,519,044,091	100.00

TABLE 5-5. TOTAL TRI ON-SITE RELEASES AND OFF-SITE TRANSFERS BY INDUSTRY, 1987

TOTAL TRI RELEASE/ TRANSFER	SIC	INDUSTRY	TOTAL TRI ON-SITE RELEASES		TOTAL TRI OFF-SITE TRANSFERS		TOTAL TRI RELEASES/ TRANSFERS	
			Pounds	Percent	Pounds	Percent	Pounds	Percent
10	20	Food Products	71,107,228	0.40	215,904,456	4.74	287,011,684	1.27
21	21	Tobacco Manufacturers	7,709,865	0.04	2,752,016	0.06	10,461,881	0.05
6	22	Textile Mill Products	221,311,854	1.23	128,599,268	2.82	349,911,142	1.55
22	23	Apparel	2,339,342	0.01	2,431,029	0.05	4,770,371	0.02
20	24	Lumber and Wood Products	30,505,830	0.17	5,454,914	0.12	35,960,744	0.16
17	25	Furniture and Fixtures	51,004,224	0.28	8,711,251	0.19	59,715,475	0.27
2	26	Paper Products	2,493,515,106	13.88	313,894,378	6.89	2,807,409,484	12.47
16	27	Printing, Publishing	54,128,225	0.30	8,808,163	0.19	62,936,388	0.28
1	28	Chemical Products	10,584,289,998	58.91	1,504,539,673	33.04	12,088,829,671	53.68
5	29	Petroleum Refining	506,066,173	2.82	256,295,296	5.63	762,361,469	3.39
11	30	Rubber and Plastic Products	198,694,443	1.11	78,402,170	1.72	277,096,613	1.23
18	31	Leather Products	16,224,136	0.09	35,863,192	0.79	52,087,328	0.23
13	32	Stone, Clay, Glass Products	59,740,337	0.33	57,228,400	1.26	116,968,737	0.52
3	33	Primary Metals	1,452,197,387	8.08	1,141,040,654	25.06	2,593,238,041	11.52
8	34	Fabricated Metals	125,425,650	0.70	180,863,356	3.97	306,289,006	1.36
14	35	Machinery, except Electrical	54,798,715	0.31	44,292,657	0.97	99,091,372	0.44
9	36	Electric and Electronic Equip.	133,183,368	0.74	163,933,864	3.60	297,117,232	1.32
7	37	Transportation Equipment	222,887,613	1.24	109,509,394	2.40	332,397,007	1.48
15	38	Measuring, Photographic Goods	49,648,384	0.28	31,492,953	0.69	81,141,337	0.36
19	39	Misc. Manufacturing	25,378,482	0.14	10,945,991	0.24	36,324,473	0.16
4		Multiple SIC codes in 20 - 39	1,477,784,604	8.23	232,200,110	5.10	1,709,984,714	7.59
12		No SIC codes in 20 - 39	127,628,392	0.71	20,311,530	0.45	147,939,922	0.66
TOTAL			17,965,569,356	100.00	4,553,474,735	100.00	22,519,044,091	100.00
PERCENT OF TOTAL RELEASES/TRANSFERS			79.78		20.22		100.00	

Facilities in more than one industrial category¹ accounted for 1.7 billion pounds (eight percent) of total TRI releases and transfers. These multiple-category reports may lead to underestimates of the amounts of chemicals released or transferred by some industries. For instance, the Chemical industry appears frequently as one of the two (or more) industries reported by facilities with multiple classifications, but the releases from those facilities cannot be assigned to the Chemical industry since it is not known what portion of the TRI data originates from chemical operations and what portion from other activities at the facilities.

Eight percent of TRI releases and transfers were from facilities reporting more than one industrial category.

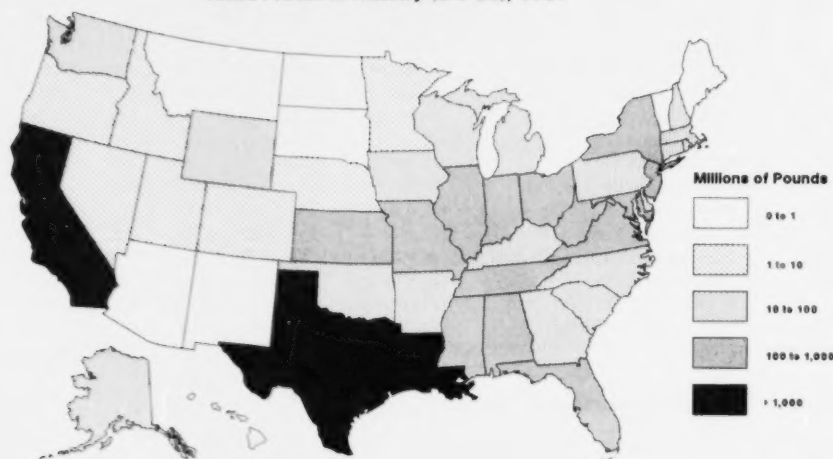
¹ Facilities were permitted to file under more than one Standard Industrial Classification (SIC) code. Facilities with more than one major (2-digit SIC) industry classification are categorized as "Multiple" in this report. See Appendix C for a list of the industries (by SIC code) that are required to report under TRI.

Chapter 5

The geographic distribution of Chemical Industry releases and transfers differed from the overall distribution.

Industrial data can be combined with geographic information for more specific analyses of TRI data. For example, the nationwide distribution of total TRI releases and transfers from the Chemical industry (Map 5-2, above) can be compared with the TRI totals for all industries in Map 5-1. Some states emerge as dominant sources of Chemical industry totals that are not among the highest-ranking states for TRI data overall. Illinois, Virginia, and Florida ranked among the top ten states for the chemical industry, replacing one for one other states in their region that are in the top ten for TRI overall – Michigan, Mississippi, and Georgia (Figure 5-2, above).

Total Releases of TRI Chemicals Reported by the Chemical and Allied Products Industry (SIC 28), 1987



Map 5-2.
TRI Releases and Transfers Reported by Facilities in the Chemical Industry, 1987.

A single industrial segment was often responsible for a large share of the total TRI releases and transfers for an entire industry.

Industries can also be examined in greater detail by analyzing the contribution of industry segments to TRI releases and transfers (Table 5-6, above). For the Chemical and Allied Products industry, almost half (43 percent) of all releases and transfers by this industry were from the printing inks, explosives and other chemicals segment. In the Petroleum industry, 93 percent of the releases and transfers were generated by petroleum refineries. Table 5-6 shows the Paper and Primary Metals industries as additional examples of how TRI transfers and releases may be distributed within broad industry categories.

TABLE 5-6. BREAKDOWN OF TOTAL TRI RELEASES AND TRANSFERS BY
INDUSTRY SEGMENT FOR FOUR INDUSTRIES, 1987

SIC CODE	INDUSTRY	TOTAL RELEASES/TRANSFERS	
		Pounds	Percent
26-	Paper & Allied Products - General	14,350,047	0.51
261	Pulp Mills	644,522,276	22.96
262	Paper Mills, except Building Paper	372,890,005	13.28
263	Paperboard Mills	316,979,900	11.29
264	Paper Products & Coatings	106,354,345	3.79
265	Paperboard Boxes	10,530,576	0.38
266	Building Paper & Building Board Mills	4,693,600	0.17
	Multiple SIC codes in 26	1,337,088,735	47.63
	Total	2,807,409,484	100.00
28-	Chemicals & Allied Products - General	17,175,923	0.14
281	Industrial Inorganic Chemicals	1,722,789,318	14.25
282	Plastics & Synthetic Organics	533,077,745	4.41
283	Pharmaceutical & Biological Products	563,751,841	4.66
284	Soaps, Cleansers, Cosmetics	20,246,433	0.17
285	Paints	70,359,051	0.58
286	Industrial Organic Chemicals	938,658,593	7.76
287	Pesticides & Agricultural Chemicals	453,220,589	3.75
289	Printing Inks, Explosives & Other	5,317,647,271	43.99
	Multiple SIC codes in 28	2,451,902,907	20.28
	Total	12,088,829,671	100.00
29-	Petroleum Refining & Allied Industries - General	29,407,369	3.86
291	Petroleum Refining	709,394,979	93.05
295	Paving Mixtures, Asphalt Coatings	1,739,654	0.23
299	Lubricating Oils & Other	15,333,636	2.01
	Multiple SIC codes in 29	6,485,831	0.85
	Total	762,361,469	100.00
33-	Primary Metals - General	44,865,775	1.73
331	Blast Furnaces & Basic Steel Products	886,117,579	34.17
332	Iron & Steel Foundries	61,182,139	2.36
333	Primary Nonferrous Metals	879,236,251	33.90
334	Secondary Nonferrous Metals	457,017,572	17.62
335	Rolling & Drawing of Nonferrous Metals	89,628,998	3.46
336	Nonferrous Foundries (Casting)	17,269,421	0.67
339	Primary Metal Products & Other	51,518,309	1.99
	Multiple SIC codes in 33	106,401,997	4.10
	Total	2,593,238,041	100.00

Nearly half of the Chemical industry's TRI total was discharged to surface water.

Industrial Patterns of Releases and Transfers

Industries generated distinct patterns of TRI releases and transfers. Almost half (47 percent) of the Chemical industry's total was discharged to surface water; underground injection releases accounted for another 24 percent (Figure 5-3, Table 5-7). Discharges to surface water also accounted for a large fraction (78 percent) of the Paper industry's total. Facilities in the Primary Metals industry released 1.4 billion pounds of TRI chemicals to land and transferred 960 million pounds off-site, which accounted for 76 percent of the industry's total releases and transfers. The Transportation industry accounted for only one percent of the TRI total, but contributed eight percent of TRI air emissions total for all industries because it had a large proportion of air emissions.

Total TRI releases and transfers of sodium sulfate by the Chemical and Allied Products industry were 7.7 billion pounds or 64 percent of the industry's total. Even without these sodium sulfate releases and transfers, however, the Chemical industry would still have been responsible for 42 percent of the TRI total and remain the industry with the largest proportion of all TRI releases and transfers.

TABLE 5-7. AMOUNT OF TRI RELEASES AND TRANSFERS BY TYPE BY INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL AIR RELEASES		SURFACE WATER		TRANSFERS TO PUBLIC SEWAGE	
		Pounds	Percent	Pounds	Percent	Pounds	Percent
20	Food Products	17,337,833	6.04	30,560,639	10.65	205,826,534	71.71
21	Tobacco Manufacturers	7,566,510	72.32	132,545	1.27	2,293,820	21.93
22	Textile Mill Products	38,305,895	10.95	182,363,632	52.12	119,540,333	34.16
23	Apparel	2,295,032	48.11	42,810	0.90	2,336,808	48.99
24	Lumber and Wood Products	26,879,647	74.75	1,001,064	2.78	1,545,461	4.30
25	Furniture and Fixtures	50,926,135	85.26	47,984	0.08	853,880	1.43
26	Paper Products	232,639,586	8.29	2,183,493,703	77.78	184,880,068	6.59
27	Printing, Publishing	54,122,107	85.99	3,521	0.01	3,444,032	5.47
28	Chemical Products	946,395,722	7.83	5,835,403,944	48.27	784,202,550	6.49
29	Petroleum Refining	79,137,824	10.36	366,051,900	48.02	50,530,645	6.63
30	Rubber and Plastic Products	143,780,863	51.88	54,077,618	19.52	48,224,867	17.40
31	Leather Products	14,096,156	27.07	1,959,658	3.76	31,984,904	61.41
32	Stone, Clay, Glass Products	27,035,373	23.11	1,322,017	1.13	7,146,933	6.11
33	Primary Metals	234,283,732	9.03	105,944,217	4.09	180,432,302	6.96
34	Fabricated Metals	109,921,878	35.89	9,079,239	2.96	76,585,656	25.00
35	Machinery, except Electrical	49,698,725	50.15	4,439,271	4.48	10,528,549	10.63
36	Electric and Electronic Equip.	110,349,790	37.14	13,080,342	4.40	85,642,196	28.62
37	Transportation Equipment	213,563,972	64.25	3,878,314	1.17	18,199,214	5.48
38	Measuring, Photographic Goods	46,331,167	57.10	3,153,101	3.89	9,768,977	12.04
39	Misc. Manufacturing	24,865,197	88.45	264,802	0.73	2,103,483	5.79
	Multiple SIC codes in 20 - 39	211,289,610	12.36	799,136,129	46.73	100,432,157	5.87
	No SIC codes in 20 - 39	14,735,754	9.98	20,237,455	13.68	9,015,992	6.09
	GRAND TOTAL	2,855,542,710	11.79	9,615,673,925	42.70	1,935,517,370	8.60

Industrial Activities and Uses

Facilities that reported *manufacturing* as their sole activity with TRI chemicals submitted only seven percent of the total number of 1987 TRI forms received by EPA, but accounted for 56 percent (12.1 billion pounds) of all TRI releases and transfers (Figure 5-4). (Industrial activities and uses are detailed in Chapters 2 and 3.)

Fifty-six percent of TRI releases and transfers were from facilities with manufacturing activities only.

Facilities that reported *processing only* submitted 28 percent of all TRI forms but released or transferred only six percent of the total. Facilities that reported *other uses only* submitted the largest portion of forms (44 percent) but accounted for only 12 percent of the total TRI releases and transfers. *Combined uses* were reported on 20 percent of all TRI forms and accounted for 27 percent of all releases and transfers.

TABLE 5-7 (Continued)

INDUSTRY	TOTAL ON-SITE LAND		UNDERGROUND INJECTION		TRANSFERS OFF-SITE		TOTAL TRI RELEASES/ TRANSFERS	TOTAL RELEASES/ TRANSFERS
	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	RANK
Food Products	23,018,190	8.02	190,566	0.07	10,077,922	3.51	267,011,684	10
Tobacco Manufacturers	10,810	0.10	0	0.00	458,196	4.38	10,461,861	21
Textile Mill Products	642,327	0.18	0	0.00	9,058,955	2.59	349,911,142	6
Apparel	1,500	0.03	0	0.00	94,221	1.98	4,770,371	22
Lumber and Wood Products	2,625,119	7.30	0	0.00	3,909,453	10.87	35,960,744	20
Furniture and Fixtures	28,105	0.05	0	0.00	7,857,362	13.18	59,715,475	17
Paper Products	77,350,923	2.78	30,894	0.00	129,014,310	4.80	2,807,409,484	2
Printing, Publishing	2,597	0.00	0	0.00	5,364,131	8.52	62,936,388	16
Chemical Products	900,323,396	7.45	2,902,166,938	24.01	720,337,123	5.96	12,088,629,671	1
Petroleum Refining	39,701,782	5.21	21,174,667	2.78	205,764,651	26.99	782,361,469	5
Rubber and Plastic Products	806,162	0.29	49,800	0.02	30,177,303	10.89	277,098,613	11
Leather Products	166,320	0.32	0	0.00	3,878,288	7.45	52,087,326	18
Stone, Clay, Glass Products	25,056,647	21.42	6,326,300	5.41	50,081,467	42.62	118,968,737	13
Primary Metals	1,021,550,898	39.39	90,418,540	3.49	960,608,352	37.04	2,593,238,041	3
Fabricated Metals	4,970,842	1.62	1,453,671	0.47	104,277,700	34.05	308,289,008	8
Machinery, except Electrical	660,719	0.67	0	0.00	33,764,108	34.07	96,091,372	14
Electric and Electronic Equip.	7,315,930	2.48	2,437,308	0.82	78,291,668	26.35	297,117,232	9
Transportation Equipment	5,397,988	1.62	47,339	0.01	81,310,180	27.47	332,397,007	7
Measuring, Photographic Good	164,116	0.20	0	0.00	21,725,976	26.78	81,141,337	15
Misc. Manufacturing	248,233	0.66	250	0.00	8,842,508	24.34	38,324,473	19
Multiple SIC codes in 20 - 39	249,504,529	14.59	217,854,136	12.74	131,767,953	7.71	1,709,984,714	4
No SIC codes in 20 - 39	92,342,831	62.42	312,352	0.21	11,295,538	7.64	147,939,922	12
GRAND TOTAL	2,451,689,964	10.89	3,242,462,757	14.40	2,617,957,385	11.63	22,519,044,091	

Chapter 5

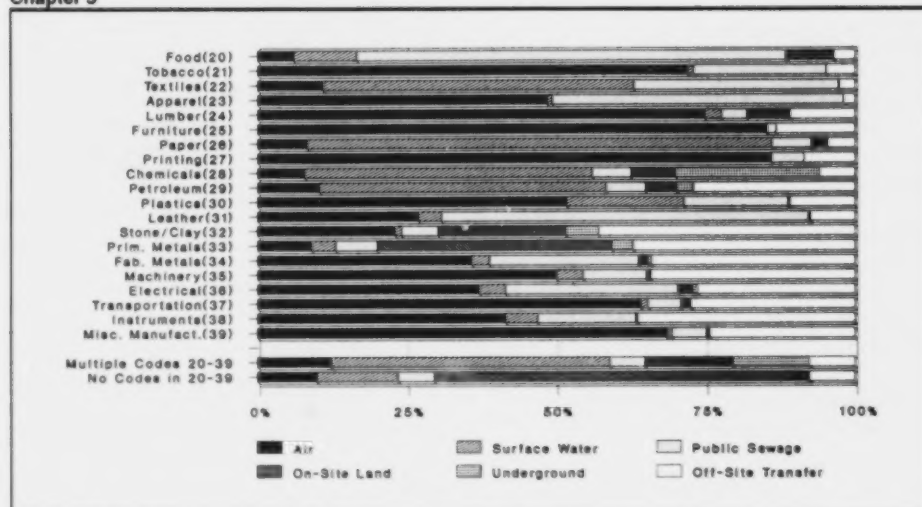


Figure 5-3. Environmental Distribution of TRI Total Releases and Transfers Reported by All Industries, 1987. By Standard Industrial Classification (SIC) Codes.

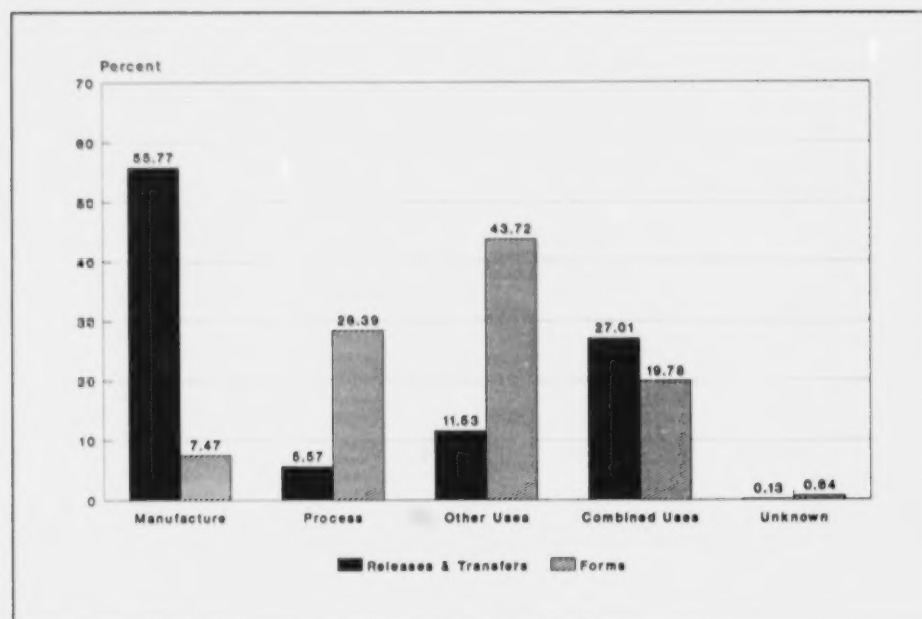


Figure 5-4. Total TRI Releases and Transfers by Industrial Activities and Uses, 1987.

Off-site Transfers

TRI facilities transferred 4.6 billion pounds, or 20 percent of the TRI total, to off-site locations for treatment or disposal. Almost half of this amount (1.9 billion pounds) was discharged to public sewage systems; the remaining 2.6 billion pounds were sent to other locations for treatment and/or disposal (see Figure 5-1, above). These facilities include private wastewater treatment plants, incinerators, landfills, and underground injection wells.

While transfers to public sewage systems are generally local, other off-site transfers may cross state lines. In general, off-site transfer data in this report refer to facilities and states where the chemicals originated, rather than those to which they were transferred. Chapters 10 and 12 describe facilities and states that *received* off-site transfers.

Figure 5-2 (above) shows the relationship of on-site releases to off-site transfers in 20 states with the largest TRI totals. Three states accounted for 40 percent of total off-site transfers: Michigan (540 million pounds); Texas (282 million pounds); and Ohio (232 million pounds) (Table 5-2, above).

States also differed markedly in the degree to which their facilities transferred wastes off-site. Michigan facilities transferred 73 percent of their TRI total off-site; Pennsylvania and Vermont followed with 41 percent and 39 percent, respectively. On the other hand, only two percent of California's TRI total, and six percent of Louisiana's were transferred to off-site facilities, the remainder being on-site releases.

Industries too differ in their patterns of on-site releases/off-site transfers. The Primary Metals industry transferred 37 percent of its TRI total off-site; the Chemical industry only 6 percent (Table 5-7, above). Together, these two industries accounted for 64 percent of total off-site transfers for all industries reporting under TRI.

Over four billion pounds of TRI chemicals were transferred in 1987 to off-site locations for storage, treatment, or disposal.

Facilities in Michigan, Texas, and Ohio generated 40 percent of all TRI off-site transfers.

Michigan facilities transferred 73 percent of their TRI total off-site.

Twenty-five TRI chemicals accounted for 94 percent of total TRI releases and transfers in 1987.

Acids, bases and salts accounted for 69 percent of total TRI releases and transfers in 1987.

Maps can be used to compare patterns of releases and transfers

Chemical Releases and Transfers

The 25 chemicals with the largest TRI totals accounted for 94 percent of all releases and transfers in 1987 (Chapter 4, Table 4-2). As mentioned earlier, 12.1 billion pounds of sodium sulfate dominated TRI totals, accounting for 54 percent of all releases and transfers. Aluminum oxide was the only other chemical with a TRI total of greater than one billion pounds.

A total of 123 of the 328 TRI chemicals and categories were released in quantities of over one million pounds. Nineteen chemicals were reported in amounts smaller than 1,000 pounds (see Chapter 4).²

Chemical Classes

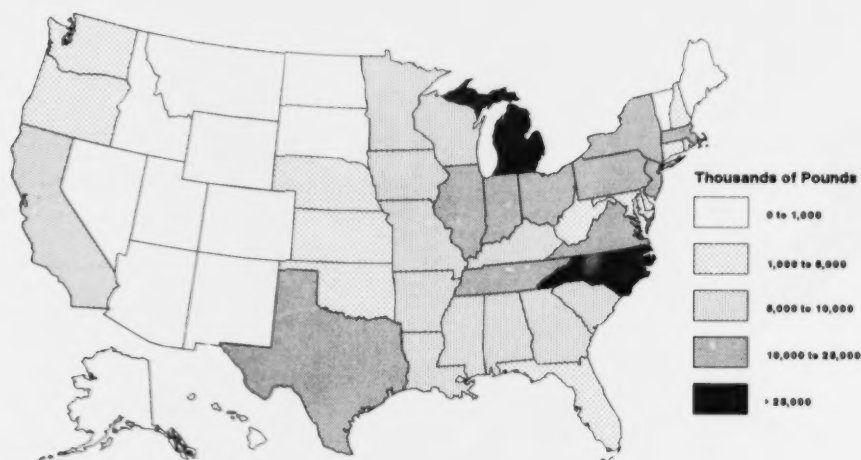
Acids/bases/salts (of which sodium sulfate is a member) accounted for 69 percent (15.5 billion pounds) of total TRI releases and transfers in 1987. Metals and metal compounds followed with 15 percent of the total, and organics with 10 percent (see Chapter 4, Figure 4-1). No other chemical class accounted for more than ten percent of the TRI total (see Chapter 4 for a discussion of the chemical classes).

Within each class, a few chemicals accounted for the bulk of the total of the class. Sodium sulfate and five other acids/bases/salts accounted for 96 percent of the total releases and transfers for the class. The top five metals and metal compounds accounted for 90 percent in that class. Five top chemicals also accounted for 99 percent of non-metals; 81 percent of halo-organics; and 60 percent of organics.

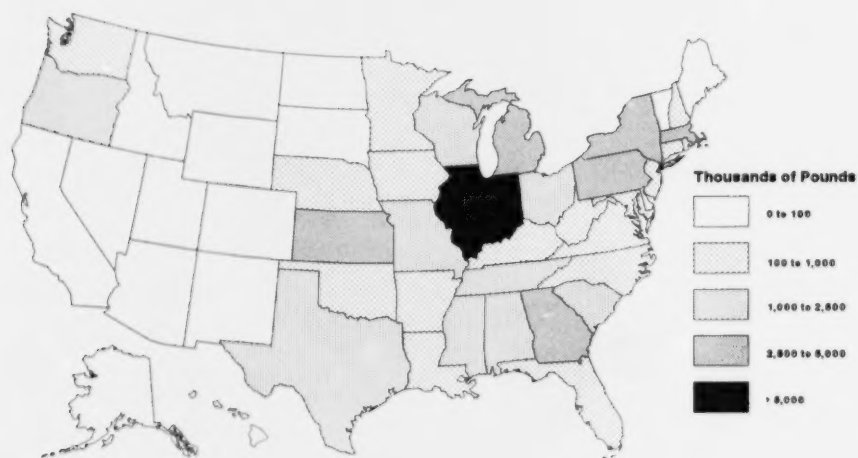
Selected Chemicals

The geographical distribution of TRI releases and transfers differ for different chemicals. Maps 5-3 through 5-8 show the TRI total releases and transfers in 1987 for a variety of chemicals. Comparing 1,1,1-trichloroethane to trichloroethylene, for instance, it is apparent that although Illinois and Indiana were large contributors for both chemicals, California and Connecticut had large TRI sums for 1,1,1-trichloroethane, but relatively small amounts for trichloroethylene. North Carolina and Michigan topped the states for toluene releases and transfers, while the Southwest played a predominant role in the TRI total for arsenic compounds.

² Not including the 55 TRI chemicals for which no reports were received at all. See Table 4-3.



Map 5-3.
Total Releases and Transfers of Toluene Reported to TRI, 1987.

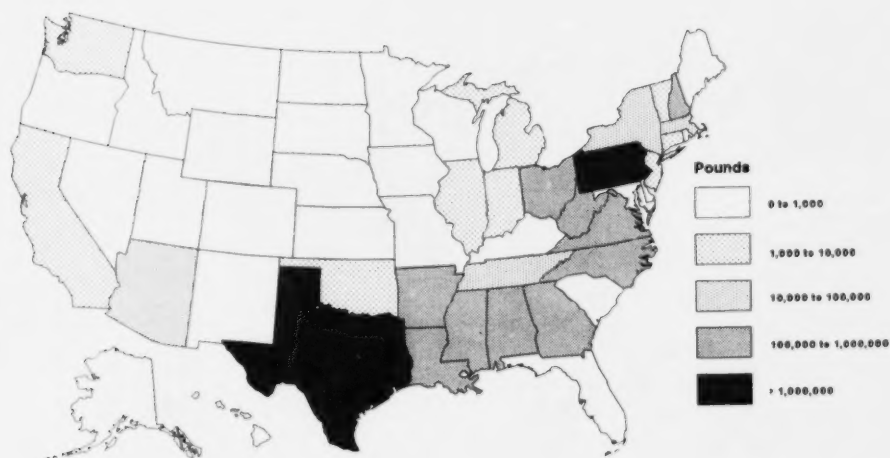


Map 5-4.
Total Releases and Transfers of Trichloroethylene Reported to TRI, 1987.



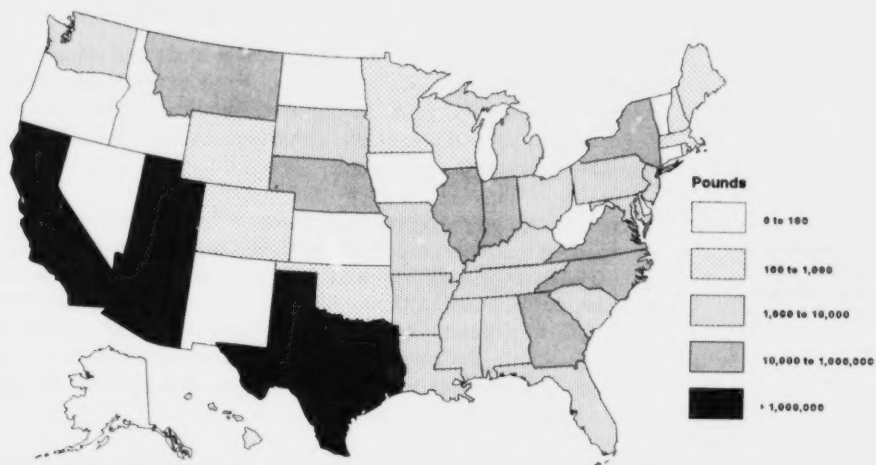
Map 5-5.

Total Releases and Transfers of 1,1,1-Trichloroethane Reported to TRI, 1987.

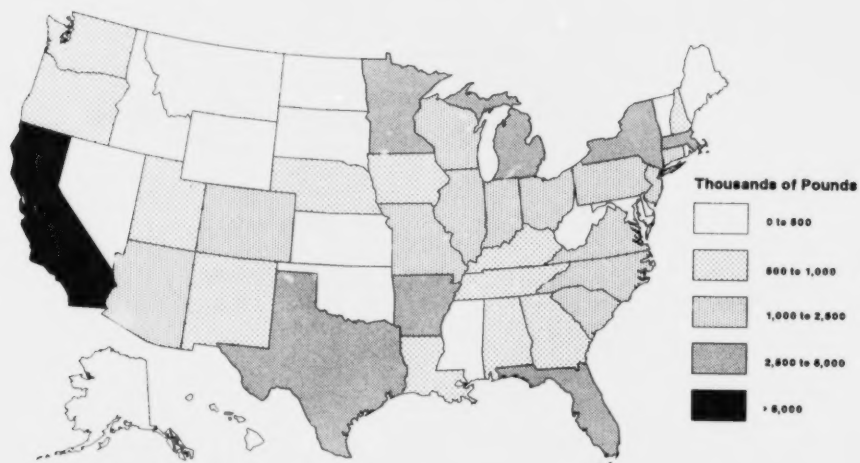


Map 5-6.

Total Releases and Transfers of Asbestos Reported to TRI, 1987.



Map 5-7.
Total Releases and Transfers of Arsenic Compounds Reported to TRI, 1987.



Map 5-8.
Total Releases and Transfers of Freon 113 Reported to TRI, 1987.

Facility Methods for Determining TRI Data

TRI instructed facilities to report chemical releases and transfers to the extent that data were available or reasonably ascertainable, and to indicate how they arrived at the reported amounts. Actual measurements were to be used if available. Otherwise, facilities provided data based on estimates or calculation.

Eighteen percent of TRI releases and transfers were actual measurements.

Figure 5-5 displays percentage of releases and transfers according to the different methods used to arrive at the data. The largest portion of the TRI data (8.6 billion pounds, or 38 percent) was reported based on mass balance calculations. Another 25 percent were reported using "other" estimates (such as other engineering calculations or best judgement); 18 percent were measured and a small fraction were based on published emission factors. Reporting methods for the remainder were not indicated.

Different methods prevailed in different environmental media (Figure 5-6). For instance, almost 24 percent of all releases to land were directly measured, while only nine percent of air emissions were

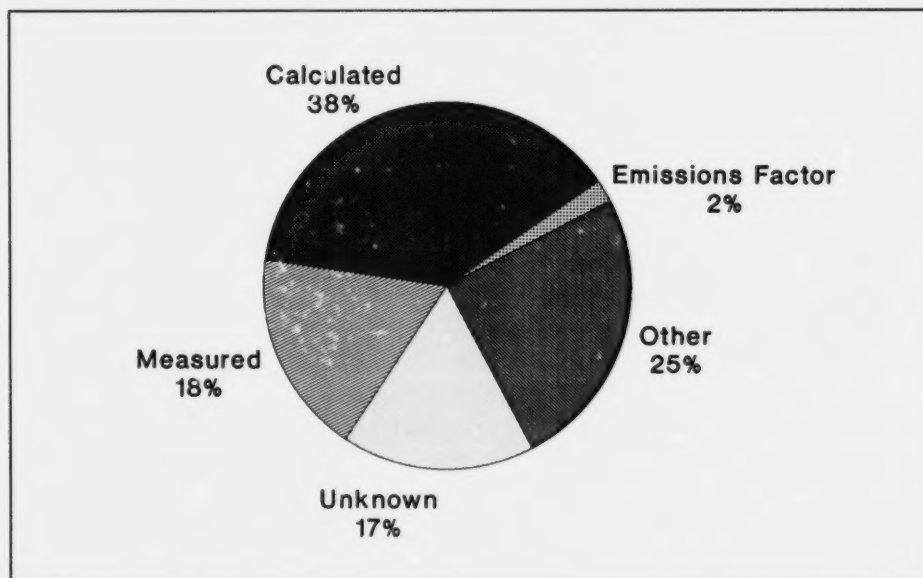


Figure 5-5.
Basis of Estimates for total TRI Releases and Transfers, 1987.

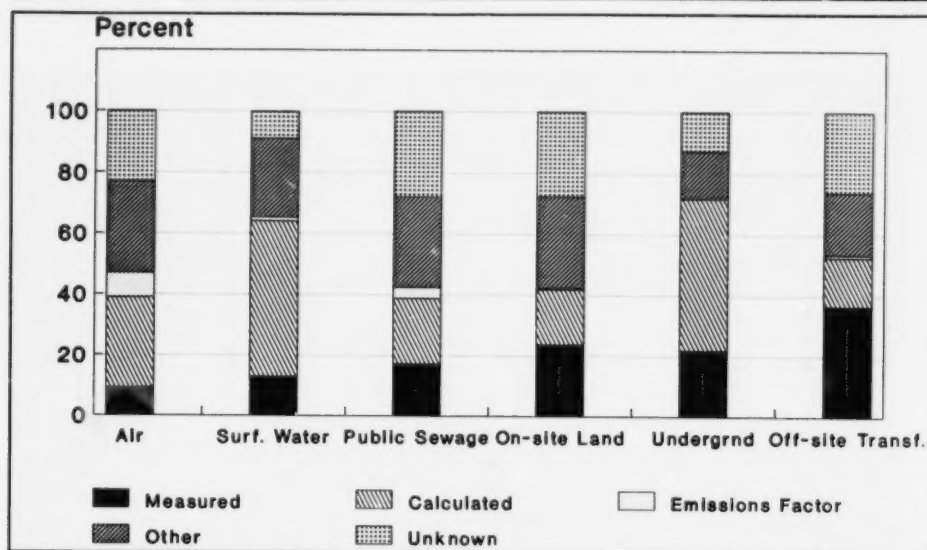
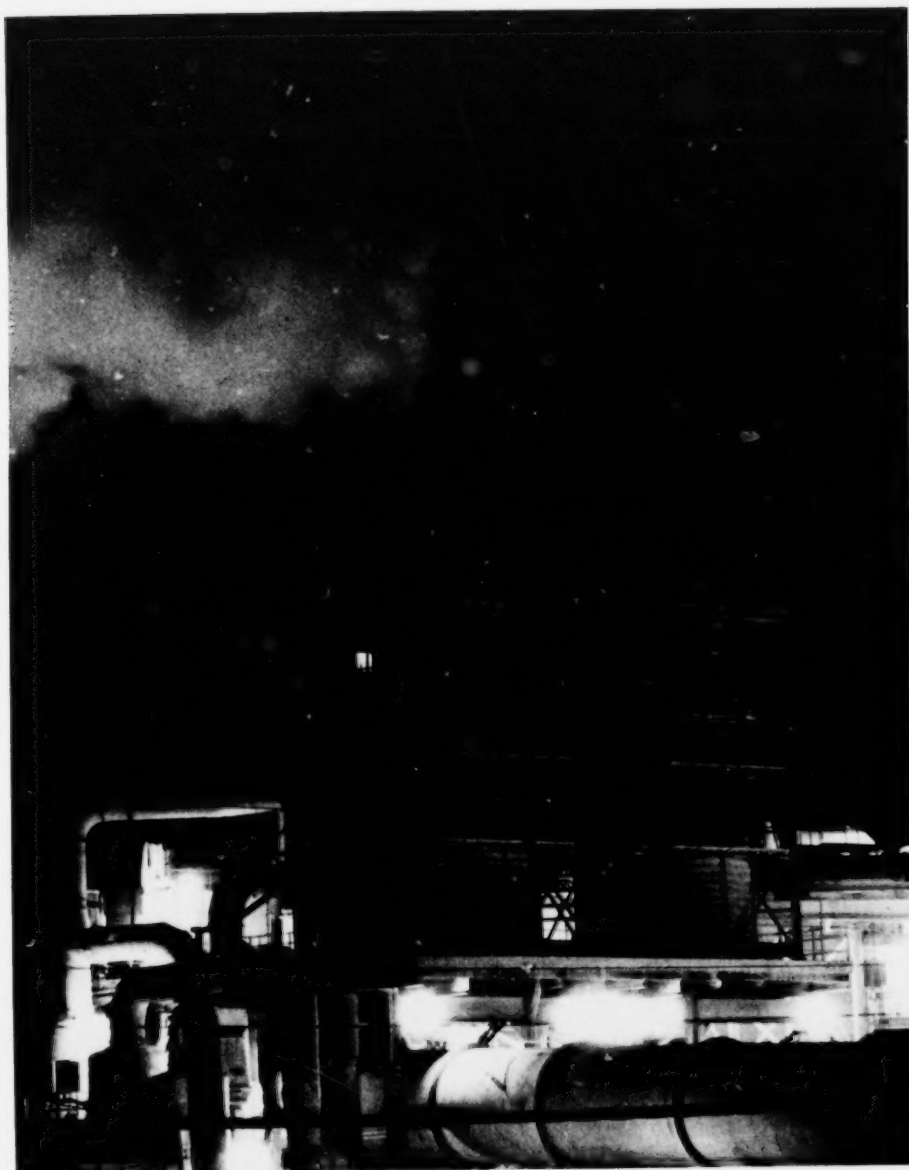


Figure 5-6.
Basis of Estimate by TRI Release and Transfer Type, 1987.

measured. Such differences are likely to arise from the fact that the land releases are more readily contained and collected for measurement, whereas air emissions tend to be dispersed, uncontained, and difficult to measure.

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Chapter 6. Air Emissions

Introduction

Facilities filing Toxics Release Inventory (TRI) forms reported total air emissions of 2.7 billion pounds for 1987, which is 12 percent of the 22.5 billion pounds of TRI chemical releases and transfers into the total environment for 1987 (Figure 6-1).

Of the 2.7 billion pounds of TRI air emissions, 1.8 billion pounds (68 percent) were **point source** emissions, while 0.8 billion pounds (32 percent) were **fugitive** emissions. Point source emissions are releases to the air from a discrete source, such as a smokestack or vent. Fugitive emissions do not have a clearly identifiable single point of origin, and include such examples as evaporative losses and leaks.

Facilities reported releases of 2.7 billion pounds of TRI chemicals into the air in 1987.

Sixty-eight percent of TRI air emissions were from point sources, 32 percent were fugitive emissions.

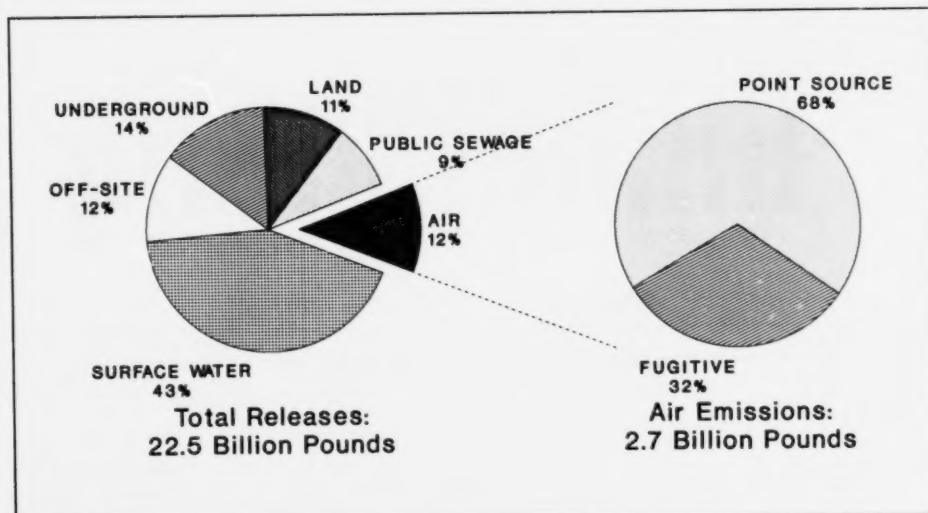


Figure 6-1.
Air Emissions Compared to Total TRI Releases and Transfers, 1987.

This chapter presents an overview of the TRI air emissions information for 1987 and reviews the locations of the largest emissions, the industries that account for the largest emissions, and the identity of the TRI chemicals emitted to air in 1987.¹

Geographical Distribution of Air Emissions

States

Ten states accounted for 50 percent of the total TRI air emissions for 1987.

Texas facilities reported the largest total air emissions of TRI chemicals for 1987 (Map 6-1, Table 6-1). That state's 239 million pounds of TRI air emissions represented 9 percent of all releases reported to air under TRI nationwide. Figure 6-2 illustrates the relative contributions of point source and fugitive emissions to TRI air release totals reported in each of the 20 states reporting the largest total air emissions for 1987. Ten states accounted for 50 percent of the total air emissions reported for 1987.

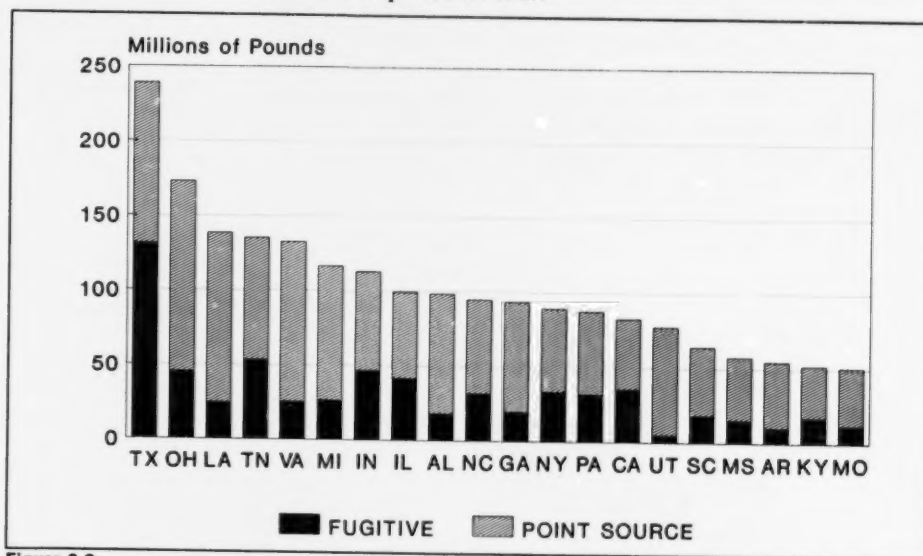
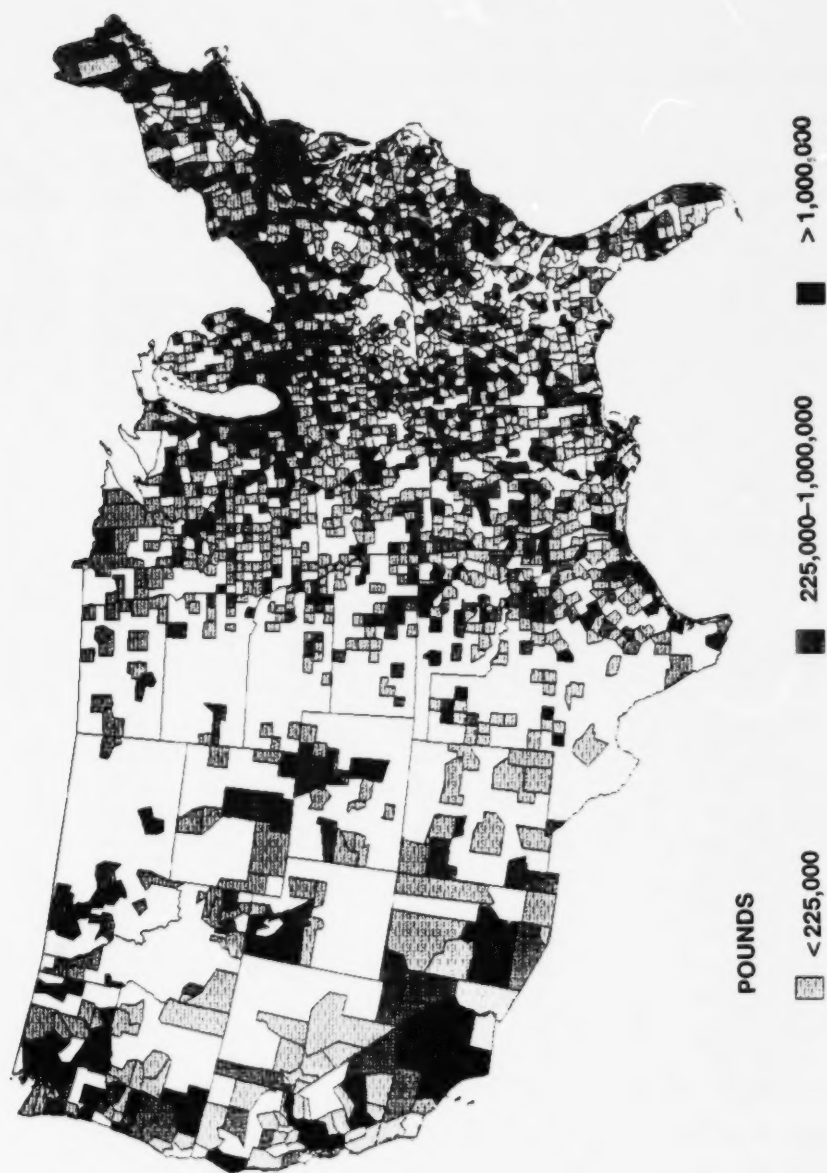


Figure 6-2.

The 20 States with the Largest Total Air Emissions of TRI Chemicals, 1987.

- 1 TRI release and transfer data are not direct indicators of risk to human health or exposure to the chemicals reported. Nor do they necessarily present a total picture of all hazardous chemicals released to the atmosphere. Chapter 2 describes the scope of TRI data in further detail, and Box 5-C discusses the risks of TRI releases.



Map 6-1. Total Air Emissions of TRI Chemicals Reported Nationwide, by County, 1987.

TABLE 6-1. TRI FACILITIES, FORMS AND AMOUNT OF AIR EMISSIONS BY STATE, 1987

Rank	STATE	TOTAL TRI AIR EMISSIONS	TRI FACILITIES REPORTING AIR EMISSIONS	TRI FORMS REPORTING AIR EMISSIONS	TRI AIR EMISSIONS			
		Number	Number	Number	TOTAL AIR		POINT SOURCE	FUGITIVE
					Pounds	Percent	Pounds	Pounds
9	Alabama	288	1,111	98,339,784	3.70		80,087,235	18,252,549
29	Alaska	7	40	31,707,083	1.19		31,416,571	290,512
53	American Samoa	2	2	56,250	0.00		0	56,250
35	Arizona	118	342	16,565,691	0.62		9,131,772	7,433,919
18	Arkansas	234	689	54,559,906	2.05		44,131,320	10,428,586
14	California	1,268	3,863	82,708,429	3.11		46,952,684	35,755,545
40	Colorado	144	386	11,010,395	0.41		5,705,790	5,304,605
31	Connecticut	316	972	26,078,031	0.98		11,214,461	14,863,570
41	Delaware	48	177	6,036,385	0.23		4,709,325	1,327,060
21	Florida	326	825	50,196,070	1.89		30,579,110	19,616,960
11	Georgia	470	1,412	93,586,285	3.52		73,855,512	19,730,773
50	Hawaii	13	49	1,064,495	0.04		550,490	514,005
44	Idaho	35	84	4,176,707	0.16		3,084,475	1,092,232
8	Illinois	963	3,032	99,226,761	3.74		57,457,414	41,769,347
7	Indiana	566	1,925	112,870,299	4.25		66,005,829	46,864,470
26	Iowa	219	647	39,238,921	1.48		30,879,630	8,359,291
32	Kansas	150	501	24,738,143	0.93		17,032,858	7,705,285
19	Kentucky	251	1,050	51,666,181	1.95		34,135,965	17,530,216
3	Louisiana	209	1,287	138,254,193	5.21		113,446,302	24,807,891
38	Maine	66	230	14,607,382	0.55		10,784,892	3,822,490
34	Maryland	143	496	20,234,753	0.76		14,510,171	5,724,582
30	Massachusetts	467	1,297	30,081,360	1.13		20,024,864	10,056,496
6	Michigan	588	2,250	116,359,932	4.38		89,776,648	26,583,284
23	Minnesota	224	732	42,065,160	1.59		34,506,627	7,558,533
17	Mississippi	203	615	57,285,976	2.16		41,836,600	15,449,376
20	Missouri	403	1,366	50,623,710	1.91		38,334,504	12,289,206
43	Montana	24	113	5,255,856	0.20		1,222,747	4,033,109
37	Nebraska	111	284	14,403,622	0.54		10,653,619	3,750,003
52	Nevada	26	55	742,389	0.03		403,867	338,522
36	New Hampshire	96	275	12,983,935	0.49		10,068,734	2,915,201
24	New Jersey	683	2,301	41,983,116	1.58		25,387,983	16,595,133
45	New Mexico	28	92	3,831,726	0.14		2,704,713	1,127,013
12	New York	623	1,992	89,399,757	3.37		55,808,280	33,591,477
10	North Carolina	650	2,026	94,568,576	3.56		62,619,342	31,949,234
51	North Dakota	24	54	935,275	0.04		702,032	233,243
2	Ohio	1,011	3,625	172,685,650	6.50		127,286,907	45,398,743
27	Oklahoma	165	480	36,445,117	1.37		27,235,956	9,209,161
33	Oregon	157	469	20,941,392	0.79		12,228,299	8,713,093
13	Pennsylvania	810	2,773	87,547,598	3.30		55,643,150	31,904,448
39	Puerto Rico	128	387	12,867,913	0.48		5,453,741	7,414,172
42	Rhode Island	126	296	5,927,841	0.22		2,891,864	3,035,977
16	South Carolina	315	1,119	64,215,277	2.42		45,663,396	18,551,881
47	South Dakota	27	50	2,441,359	0.09		1,806,035	635,324
4	Tennessee	413	1,256	135,010,665	5.08		81,516,954	53,493,711
1	Texas	823	3,890	238,817,765	8.99		107,605,315	131,212,450
15	Utah	81	264	77,327,036	2.91		72,302,799	5,024,237
49	Vermont	39	112	1,379,661	0.05		939,015	440,646
48	Virgin Islands	1	18	2,033,873	0.08		907,773	1,126,100
5	Virginia	327	1,055	132,436,076	4.99		107,044,894	25,391,182
25	Washington	243	727	40,637,496	1.53		23,992,020	16,645,476
28	West Virginia	91	527	35,564,455	1.34		20,326,581	15,237,874
22	Wisconsin	507	1,553	48,656,361	1.83		37,736,499	10,919,862
46	Wyoming	17	76	3,154,641	0.12		1,058,894	2,095,747
TOTAL		15,289	51,281	2,655,542,710	100.00		1,811,384,858	844,158,052
PERCENT OF ALL REPORTS		79.31	69.16	11.79			8.04	3.75

States had different ratios of point source to fugitive emissions (Table 6-1). For example, while Texas ranked first for total air emissions and fugitive emissions, Ohio ranked first for point source emissions. Likewise, states such as Utah and Pennsylvania had comparatively low total reported air emissions, but relatively high point source or fugitive emissions. Facilities in most jurisdictions reported greater point source emission totals than fugitive emissions. The noteworthy exceptions to this pattern were Texas, the Virgin Islands, Rhode Island, Connecticut, Montana, Wyoming, Puerto Rico, and American Samoa.

Facilities in most states reported greater point source emissions than fugitive emissions.

Counties

Total air emissions in the top 25 counties accounted for more than one fourth (27 percent) of total air emissions of TRI chemicals (Table 6-2). The 68.1 million pounds of air emissions reported in Tooele County, Utah represented 88 percent of that state's total reported air emissions for 1987. Most of Tooele County's reported air emissions were point source emissions (68.0 million pounds, or 99 percent).

TABLE 6-2. THE 25 COUNTIES WITH THE LARGEST TOTAL TRI AIR EMISSIONS, 1987

COUNTY	STATE	TOTAL TRI AIR EMISSIONS Pounds	PERCENT OF TOTAL TRI AIR EMISSIONS IN THE STATE
TOOELE	UT	68,144,850	88.13
WARREN	VA	51,098,900	38.58
MOBILE	AL	49,266,863	50.10
ASCENSION	LA	48,218,582	34.88
UNION	OH	45,004,443	26.08
HARRIS	TX	44,494,717	18.63
SULLIVAN	TN	41,302,752	30.59
LOS ANGELES	CA	33,626,407	40.66
COOK	IL	32,560,271	32.81
KENAI-COOK INLET	AK	30,320,680	95.63
ECTOR	TX	28,762,473	12.04
MONROE	NY	26,997,832	30.20
JEFFERSON	TX	24,688,055	10.34
BRAZORIA	TX	21,757,503	9.11
CALCASIEU	LA	18,449,181	13.34
CHATHAM	GA	17,647,853	18.86
ST JAMES	LA	17,411,144	12.59
MISSISSIPPI	AR	17,231,272	31.58
HAMBLE	TN	16,334,243	12.10
WAYNE	MI	16,072,633	13.81
CALHOUN	TX	16,006,412	6.70
LAKE	IN	15,126,356	13.40
SHELBY	TN	14,143,623	10.48
ALLEGHANY	VA	14,018,774	10.59
CATAWBA	NC	13,980,480	14.78
TOTAL		722,666,299	27.21

Industries Reporting TRI Air Emissions

Industrial Distribution

Four industries accounted for 61 percent of the total TRI air emissions for 1987.

Four industries accounted for 61 percent of the total air emissions of TRI chemicals reported for 1987 (Figure 6-3, Table 6-3). The Chemical and Allied Products industry was the largest emitter, with industry-wide air emissions of 946 million pounds (36 percent of all reported air emissions), four times the amount of any other industry. Other top emitters were the Primary Metals, the Paper and Allied Products, and the Transportation Equipment industries. Facilities reporting multiple industry categories accounted for an additional eight percent of the total air emissions. (Appendix C lists industries covered by TRI.)

The ratio of point to fugitive air emissions was around 70 to 30 for most industries (Table 6-3). The ratio for the Chemical industry was 70 percent point to 30 percent fugitive; for Primary Metals the ratio was 69 to 31. The Paper industry had a higher than average ratio of point source to fugitive emissions, with fully 83 percent of its air emissions emanating from point sources. In contrast, for three industries—Food Products, Apparel, and Printing/Publishing—the ratio was reversed, with approximately 30 percent point source emissions and 70 percent fugitive.

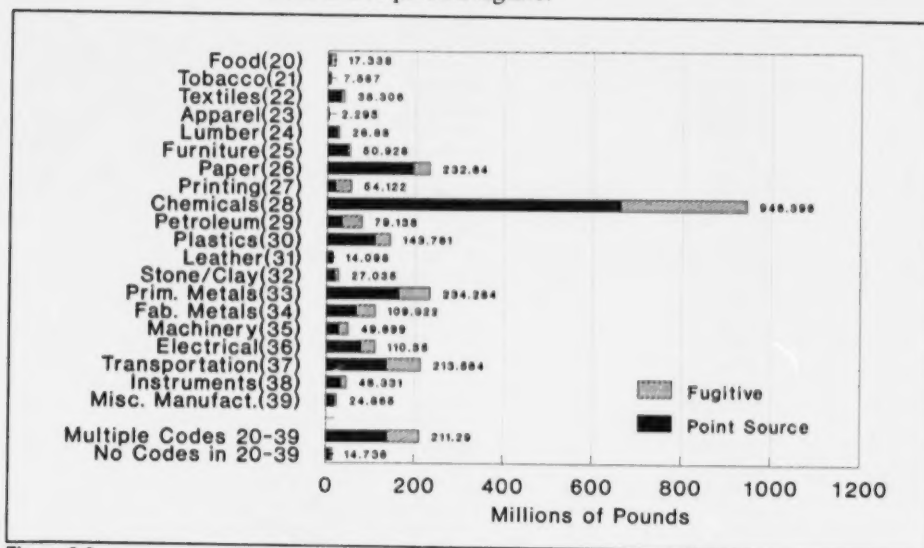
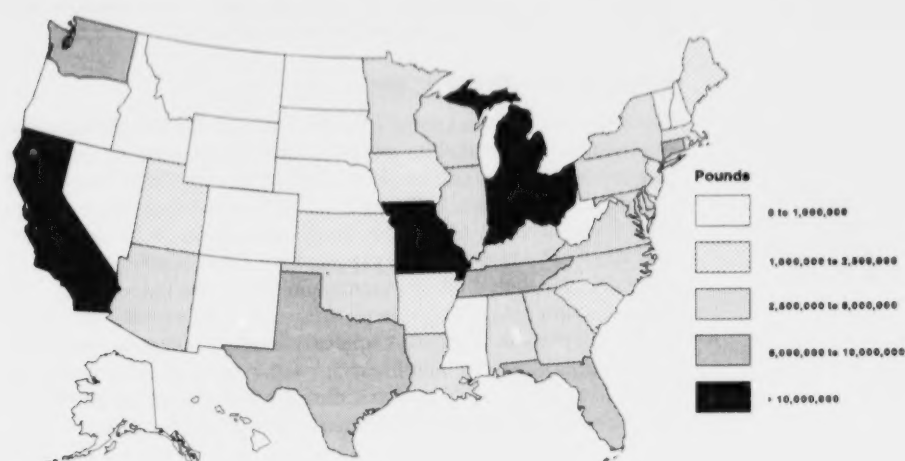


Figure 6-3.
Total Air Emissions of TRI Chemicals by Industry, 1987.



Map 6-2.
Air Emissions of TRI Chemicals by the Transportation Industry (SIC 37), 1987.

TABLE 6-3. TRI FACILITIES, FORMS AND AIR EMISSIONS BY INDUSTRY, 1987

TOTAL AIR EMISSIONS Rank	SIC CODE INDUSTRY	FACILITIES WITH AIR EMISSIONS Number	FORMS WITH AIR EMISSIONS Number	AIR EMISSIONS			PERCENT FUGITIVE OF TOTAL EMISSIONS
				TOTAL Pounds	POINT SOURCES Pounds	FUGITIVE Pounds	
18	20 Food Products	715	1,086	17,337,833	5,093,410	12,244,423	70.62%
21	21 Tobacco Manufacturers	18	44	7,566,510	3,343,943	4,222,567	55.81%
14	22 Textile Mill Products	284	538	36,305,895	28,834,010	9,471,885	24.73%
22	23 Apparel	23	38	2,295,032	701,745	1,593,287	69.42%
18	24 Lumber and Wood Products	427	1,150	26,879,647	20,405,625	6,474,022	24.09%
11	25 Furniture and Fixtures	315	1,239	50,928,135	44,445,308	6,482,827	12.73%
3	26 Paper Products	476	1,624	232,639,586	193,706,956	38,932,628	16.73%
10	27 Printing, Publishing	248	456	54,122,107	18,121,308	36,000,799	66.52%
1	28 Chemical Products	3,260	15,817	946,395,722	661,646,057	284,749,665	30.09%
9	29 Petroleum Refining	265	2,261	79,137,824	33,316,091	45,821,733	57.90%
6	30 Rubber and Plastic Products	987	2,189	143,760,863	107,645,119	36,115,744	25.12%
20	31 Leather Products	94	312	14,098,158	12,250,738	1,847,420	13.10%
15	32 Stone, Clay, Glass Products	467	1,181	27,035,373	16,763,774	10,271,599	37.99%
2	33 Primary Metals	1,053	3,630	234,283,732	161,456,085	72,827,647	31.09%
8	34 Fabricated Metals	1,938	5,092	109,921,878	67,375,722	42,546,156	38.71%
12	35 Machinery, except Electrical	663	1,568	49,698,725	26,547,979	23,150,746	46.58%
7	36 Electric and Electronic Equip.	1,236	3,679	110,349,790	77,509,333	32,840,457	29.76%
4	37 Transportation Equipment	819	3,301	213,563,972	135,275,132	78,288,840	36.66%
13	38 Measuring, Photographic Good	268	719	46,331,167	32,434,040	13,897,127	30.00%
17	39 Misc. Manufacturing	281	669	24,865,197	18,516,905	6,348,292	25.53%
5	Multiple SIC codes in 20 - 39	1,190	3,709	211,289,810	137,226,720	74,063,090	35.05%
19	No SIC codes in 20 - 39	264	801	14,735,754	8,764,856	5,971,098	40.52%
TOTAL		15,289	51,281	2,655,542,710	1,811,384,658	844,158,052	31.79%
PERCENT OF ALL REPORTING		79.31%	69.16%	10.72%	8.04%	3.75%	

Air emissions from the Transportation Equipment industry, which had a ratio 63 percent point to 37 percent fugitive, were concentrated in the Great Lakes area and in California (Map 6-2).

Industrial Activities and Uses

Facilities that reported using TRI chemicals under the *manufacture only* category accounted for just 11 percent of total TRI air emissions (Figure 6-4), in contrast to the overall pattern for TRI releases and transfers (see Chapter 5, Figure 5-4). Those reporting under *process only* accounted for a similarly small proportion of total TRI air emissions (15 percent), while reports identifying *combined uses* and *other uses* accounted for 35 percent and 38 percent respectively. The large contribution of the *other uses* category may be partially explained by the fact that many volatile chemical solvents (toluene and acetone, for example) may be employed for *other uses* such as industrial cleaners, solvents, or degreasers, during which the entire amount of the chemical may be emitted to the air through evaporation.

Facilities reporting uses other than manufacturing or processing emitted the largest amounts of air emissions.

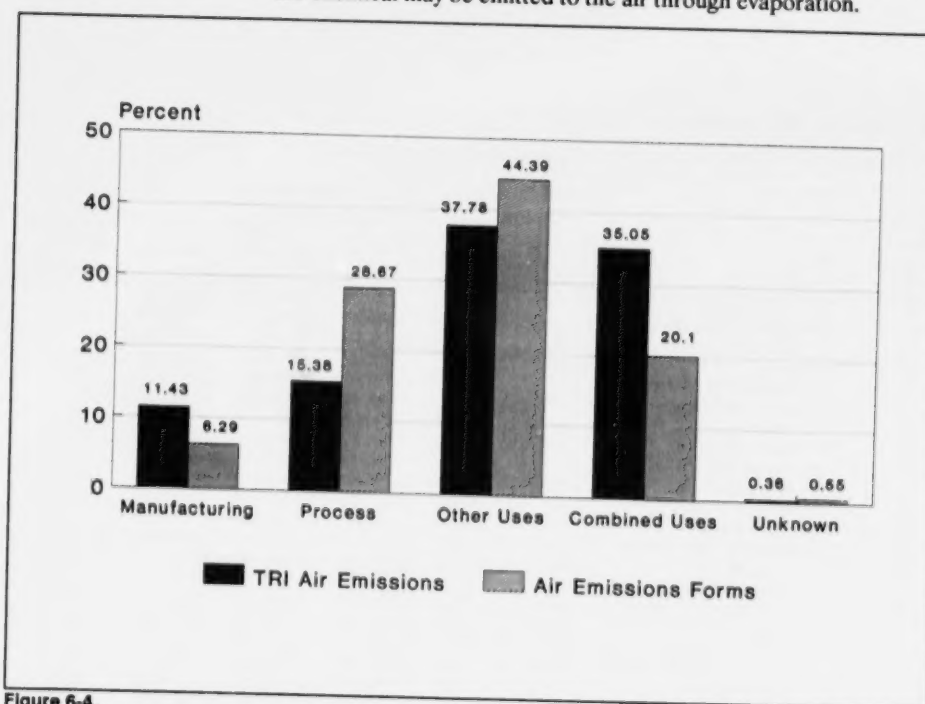


Figure 6-4.
Total TRI Air Emissions by Industrial Activities and Uses, 1987.

TRI Chemicals Emitted To Air

Twenty-five TRI chemicals accounted for more than 88 percent of all reported air emissions for 1987 (Table 6-4). These 25 chemicals contributed 2.3 billion pounds of the 2.7 billion pounds of air emissions reported for all TRI chemicals. Ammonia was the TRI chemical emitted in the largest amount (318 million pounds) in 1987.

Nineteen of the top twenty-five chemicals for TRI air emissions were released in larger amounts from point sources than through fugitive emissions. The notable exceptions include 1,1,1-trichloroethane, ethylene, propylene, Freon 113, tetrachloroethylene, and benzene. All of these chemicals are highly volatile (easily evaporated) and belong to either the organics or halo-organics classes.

Facilities reported air emissions for 257 of the 272 TRI chemicals for which some TRI releases or transfers were reported for 1987. No air emissions were reported for 15 of these 272 TRI chemicals for 1987 (Table 6-5).

Chemical Classes

Table 6-6 lists the total TRI air emissions by chemical class and includes a listing of the chemicals which are released or transferred in the largest amounts within the classes for the TRI database as a whole. (Chemical classes are defined in Chapter 4). Figure 6-5 compares total environmental releases and transfers to point source and fugitive air release totals for the chemical classes. Unlike total TRI releases and transfers, for which the acids/bases/salts class dominates, non-halogenated organics accounted for the largest portion (56 percent) of point source air emissions, followed by non-metallic inorganics (21 percent). Similarly, Figure 6-6 shows that organics accounted for the largest portion (59 percent) of fugitive air emissions. However, in this case the class of halo-organics contributed the second largest amount — 27 percent of all fugitive air emissions.

Twenty-five chemicals accounted for over 88 percent of all 1987 TRI air emissions. Ammonia was emitted to air in the largest amounts.

Only 15 of the reported TRI chemicals had no reported air emissions in 1987.

Organic (non-halogenated) TRI chemicals made up over 50 percent of all air emissions.

TABLE 6-4. THE 25 TRI CHEMICALS WITH THE LARGEST TOTAL AIR EMISSIONS, 1987

TOTAL TRI		FORMS REPORTING			TOTAL TRI		TRI AIR		TRI AIR		TRI AIR	
RELEASE/TRANSFER		TRI AIR			AIR		POINT SOURCE		FUGITIVE			
		EMISSIONS			EMISSIONS		EMISSIONS		EMISSIONS			
Rank	CHEMICAL NAME	Number	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Percent	Pounds	Percent
7	AMMONIA	2,015	318,028,225	11.98	263,255,197	14.53	54,773,028	8.49				
9	TOLUENE	3,052	258,279,298	9.73	158,224,319	8.73	100,054,979	11.85				
8	METHANOL	1,870	196,038,365	7.38	150,553,896	8.31	45,484,469	5.39				
11	ACETONE	1,981	178,348,341	6.72	93,382,054	5.16	84,966,287	10.07				
14	1,1,1-TRICHLOROETHANE	2,915	151,233,854	5.70	67,675,070	3.74	83,558,784	9.90				
13	METHYL ETHYL KETONE	2,019	145,810,523	5.49	107,662,482	5.94	38,148,041	4.52				
12	XYLENE (MXED ISOMERS)	2,625	137,243,778	5.17	104,968,124	5.80	32,255,654	3.82				
16	CARBON DISULFIDE	78	136,167,830	5.13	132,832,896	7.33	3,334,932	0.40				
17	DICHLOROMETHANE	1,329	118,439,343	4.46	76,552,562	4.23	41,886,781	4.96				
19	CHLORINE	1,179	110,349,352	4.16	104,616,580	5.78	5,732,772	0.68				
2	ALUMINUM OXIDE	860	83,845,554	3.16	50,721,534	2.80	33,124,020	3.92				
24	ETHYLENE	236	60,792,720	2.29	22,949,800	1.27	37,842,920	4.48				
25	FREON 113	991	53,105,656	2.00	17,578,656	0.97	35,529,000	4.21				
4	HYDROCHLORIC ACID	1,980	52,512,848	1.98	47,506,062	2.62	5,006,786	0.59				
26	TRICHLOROETHYLENE	821	50,254,196	1.89	26,613,963	1.47	23,640,233	2.80				
39	PROPYLENE	275	38,156,393	1.44	12,371,697	0.68	25,784,696	3.05				
28	GLYCOL ETHERS	907	38,067,081	1.43	30,987,766	1.71	7,079,315	0.84				
31	N-BUTYL ALCOHOL	864	32,640,700	1.23	24,462,853	1.35	8,177,847	0.97				
35	TETRACHLOROETHYLENE	601	32,163,556	1.21	15,922,299	0.88	16,241,257	1.92				
27	STYRENE	795	30,197,425	1.14	17,984,050	0.99	12,213,375	1.45				
43	BENZENE	455	28,233,524	1.06	9,077,750	0.50	19,155,774	2.27				
33	METHYL ISOBUTYL KETONE	698	27,522,278	1.04	16,806,167	0.93	10,716,111	1.27				
45	CHLOROFORM	160	25,368,084	0.96	17,581,276	0.97	7,786,808	0.92				
52	CARBONYL SULFIDE	19	20,882,955	0.79	20,877,594	1.15	5,361	0.00				
5	SULFURIC ACID	2,279	19,406,368	0.73	17,076,332	0.94	2,330,036	0.28				
SUBTOTAL		31,002	2,343,068,247	88.23	1,608,258,981	88.79	734,829,266	87.05				
TOTAL FOR ALL OTHERS		20,279	312,454,463	11.77	203,125,677	11.21	109,328,786	12.95				
GRAND TOTAL		51,281	2,655,542,710	100.00	1,811,384,658	100.00	844,158,052	100.00				

TABLE 6-5. TRI CHEMICALS WITH NO REPORTED AIR EMISSIONS, 1987
(Of the 272 chemicals for which some releases were reported)

1	2,4,6-TRICHLOROPHENOL
2	2,4-DIAMINOANISOLE
3	4-AMINOAZOBENZENE
4	5-NITRO-O-ANISIDINE
5	C.I. ACID BLUE 9, DIAMMONIUM SALT
6	C.I. SOLVENT YELLOW 3
7	DICOFOL
8	ETHYLENE THIOUREA
9	ETHYLENEIMINE
10	HYDRAZINE SULFATE
11	NITROGEN MUSTARD
12	N-NITROSODIPHENYLAMINE
13	POLY BROMINATED BIPHENYLS
14	PROPANE SULFONE
15	P-ANISIDINE

TABLE 6-6. TOTAL TRI AIR EMISSIONS BY CHEMICAL CLASS, 1987

TOTAL TRI RELEASE/ TRANSFER Rank	CHEMICAL NAME	TOTAL TRI AIR EMISSIONS Pounds	PERCENT OF TOTAL TRI AIR EMISSIONS	TRI POINT SOURCE AIR EMISSIONS Pounds Percent	TRI FUGITIVE AIR EMISSIONS Pounds Percent
Acids/Bases/Salts					
1	SODIUM SULFATE (SOLUTION)	5,702,418	0.21	5,586,409	0.31 116,009 0.01
3	AMMONIUM SULFATE (SOLUTION)	6,381,186	0.24	6,114,997	0.34 266,189 0.03
4	HYDROCHLORIC ACID	52,512,848	1.98	47,506,062	2.62 5,006,786 0.59
5	SULFURIC ACID	19,406,368	0.73	17,076,332	0.94 2,330,036 0.28
6	SODIUM HYDROXIDE (SOLUTION)	7,880,603	0.30	2,448,489	0.14 5,432,134 0.64
10	PHOSPHORIC ACID	1,615,570	0.06	1,224,960	0.07 390,610 0.05
	Subtotal	93,498,993	3.52	79,957,229	4.41 13,541,764 1.60
	TOTAL FOR ALL OTHERS IN CLASS	27,718,837	1.04	22,623,901	1.25 5,094,936 0.60
	TOTAL FOR CLASS	121,217,830	4.56	102,581,130	5.66 18,636,700 2.20
Halo-organics					
14	T,T,1-TRICHLOROETHANE	151,233,854	5.70	67,675,070	3.74 83,558,784 9.90
17	DICHLOROMETHANE	118,439,343	4.48	76,552,562	4.23 41,886,781 4.96
25	FREON 113	53,105,656	2.00	17,576,656	0.97 35,529,000 4.21
26	TRICHLOROETHYLENE	50,254,196	1.89	26,613,963	1.47 23,640,233 2.80
35	TETRACHLOROETHYLENE	32,183,556	1.21	15,922,299	0.88 16,261,257 1.92
	Subtotal	405,196,605	15.26	204,340,550	11.26 200,856,055 23.79
	TOTAL FOR ALL OTHERS IN CLASS	65,968,407	2.48	41,900,791	2.31 24,065,616 2.85
	TOTAL FOR CLASS	471,165,012	17.74	246,241,341	13.59 224,921,671 26.64
Metals and Metal Compounds					
2	ALUMINUM OXIDE	83,845,554	3.16	50,721,534	2.80 33,124,020 3.92
15	COPPER	2,370,791	0.09	2,121,998	0.12 248,793 0.03
16	ZINC COMPOUNDS	5,753,287	0.22	4,506,127	0.25 1,247,160 0.15
21	MANGANESE COMPOUNDS	2,043,072	0.08	1,495,407	0.08 547,665 0.06
23	ZINC (FUME OR DUST)	4,270,474	0.16	2,925,058	0.16 1,345,416 0.16
	Subtotal	98,283,178	3.70	61,770,124	3.41 36,513,054 4.33
	TOTAL FOR ALL OTHERS IN CLASS	15,481,549	0.58	9,393,671	0.52 6,087,878 0.72
	TOTAL FOR CLASS	113,764,727	4.28	71,163,795	3.93 42,600,932 5.05
Non-metallic Inorganics					
7	AMMONIA	318,026,225	11.98	263,255,197	14.53 54,773,028 6.49
19	CHLORINE	110,349,352	4.16	104,616,580	5.78 5,732,772 0.68
49	ARSENIC COMPOUNDS	181,371	0.01	146,534	0.01 34,837 0.00
50	ASBESTOS (FRIABLE)	50,455	0.00	39,132	0.00 11,323 0.00
57	CHLORINE DIOXIDE	13,652,773	0.51	11,965,949	0.66 1,686,824 0.20
	Subtotal	442,262,176	16.65	380,023,382	20.98 62,238,794 7.37
	TOTAL FOR ALL OTHERS IN CLASS	98,280	0.01	65,427	0.00 32,853 0.01
	TOTAL FOR CLASS	442,360,456	16.66	380,088,819	20.98 62,271,617 7.38
Organics (non-halogenated)					
8	METHANOL	196,038,365	7.38	150,553,896	8.31 45,484,469 5.39
9	TOLUENE	258,279,298	9.73	158,224,319	8.73 100,054,979 11.85
11	ACETONE	178,348,341	6.72	93,382,054	5.16 84,966,287 10.07
12	XYLENE (MIXED ISOMERS)	137,243,778	5.17	104,986,124	5.80 32,255,654 3.82
13	METHYL ETHYL KETONE	145,810,523	5.49	107,662,482	5.94 38,148,041 4.52
	Subtotal	915,720,305	34.48	614,810,875	33.94 300,909,430 35.65
	TOTAL FOR ALL OTHERS IN CLASS	584,605,331	22.02	391,970,969	21.64 192,634,362 22.82
	TOTAL FOR CLASS	1,500,325,636	56.50	1,006,781,844	55.58 493,543,792 58.47
34	TOTAL FOR MIXTURES	5,427,665	0.21	3,396,237	0.20 2,029,428 0.24
100	TOTAL FOR TRADE SECRETS	1,283,404	0.05	1,129,492	0.06 153,912 0.02
	GRAND TOTAL	2,655,542,710	100.00	1,811,384,658	100.00 844,158,052 100.00

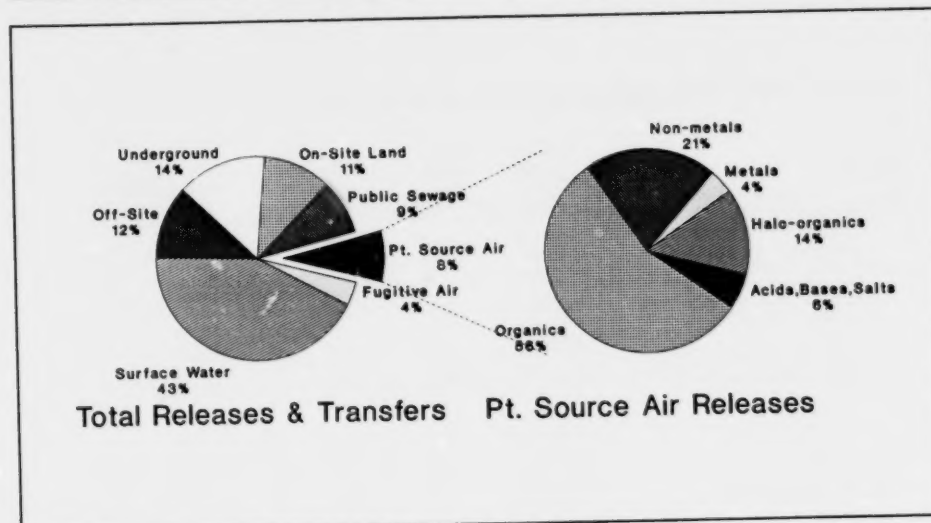


Figure 6-5. Chemical Class Breakdown of TRI Point Source Air Emissions, 1987. Total point source air emissions were 1.8 billion pounds. Emissions of Mixtures and Trade Secrets each accounted for less than one percent of the total.

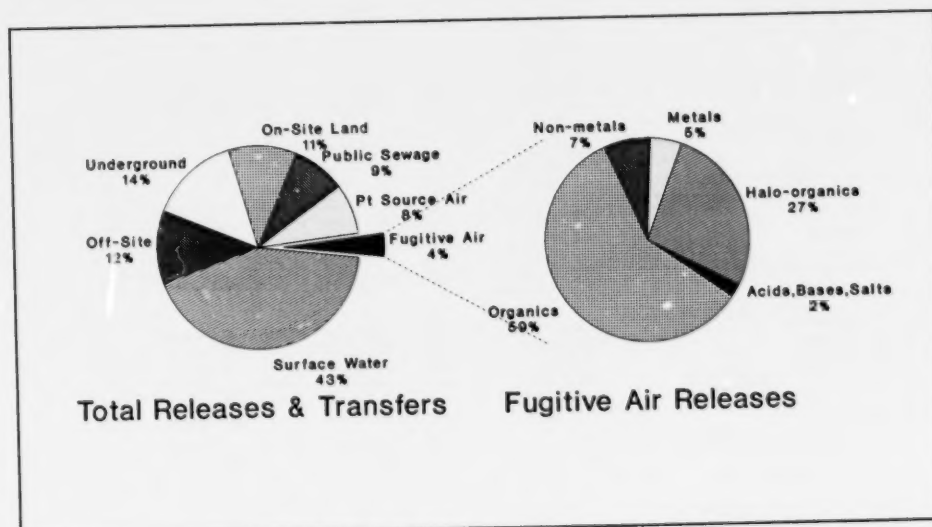


Figure 6-6. Chemical Class Breakdown of TRI Fugitive Air Emissions, 1987. Total fugitive air emissions were 844 million pounds. Emissions of Mixtures and Trade Secrets each accounted for less than one percent of the

Emissions of NESHAP Chemicals

Nine TRI chemicals and chemical categories² are also regulated under EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAP). EPA sets these emissions standards for certain air pollutants that may pose serious human health hazards, but are not covered by the National Ambient Air Quality Standards. As Table 6-7 shows, emissions of these NESHAP chemicals accounted for one percent of the total TRI air emissions.

All NESHAP chemicals are included on the TRI chemical list. Air emissions of these six chemicals accounted for one percent of the total TRI air emissions.

Of the NESHAP chemicals listed in Table 6-7, benzene accounts for the largest total air emissions for 1987 (28 million pounds, or 93 percent of the subtotal for NESHAP chemicals). Benzene emissions, reported on 481 forms (45 percent of all TRI chemical report forms for NESHAP chemicals), accounted for less than one percent of total TRI air emissions.

TABLE 6-7. TRI AIR EMISSIONS FOR NESHAP AIR POLLUTANTS, 1987

CHEMICAL NAME	TRI FORMS Number	TRI AIR EMISSIONS Pounds	TRI FUGITIVE AIR EMISSIONS Pounds	TRI POINT SOURCE AIR EMISSIONS Pounds	TOTAL TRI RELEASES/ TRANSFERS Pounds
BENZENE	481	28,233,524	19,155,774	9,077,750	32,877,292
ARSENIC COMPOUNDS	210	181,371	34,837	146,534	27,133,899
ASBESTOS (FRIABLE)	154	50,455	11,323	39,132	24,211,770
VINYL CHLORIDE	50	1,716,279	704,595	1,011,684	2,756,258
ARSENIC	104	43,532	4,240	39,292	1,573,148
MERCURY	39	23,236	17,169	6,067	310,971
MERCURY COMPOUNDS	21	2,368	751	1,617	85,935
BERYLLIUM	11	2,000	750	1,250	53,075
BERYLLIUM COMPOUNDS	8	504	2	502	7,822
SUBTOTAL	1,078	30,253,269	19,929,441	10,323,828	89,010,170
PERCENT OF TOTAL FOR NESHAPS	100.00	33.99	22.39	11.60	100.00
PERCENT OF GRAND TOTAL	1.45	1.14	2.36	0.57	0.40
TOTAL FOR ALL OTHERS	73,074	2,625,289,441	824,228,611	1,801,060,830	22,430,033,921
GRAND TOTAL	74,152	2,655,542,710	844,158,052	1,811,384,658	22,519,044,091

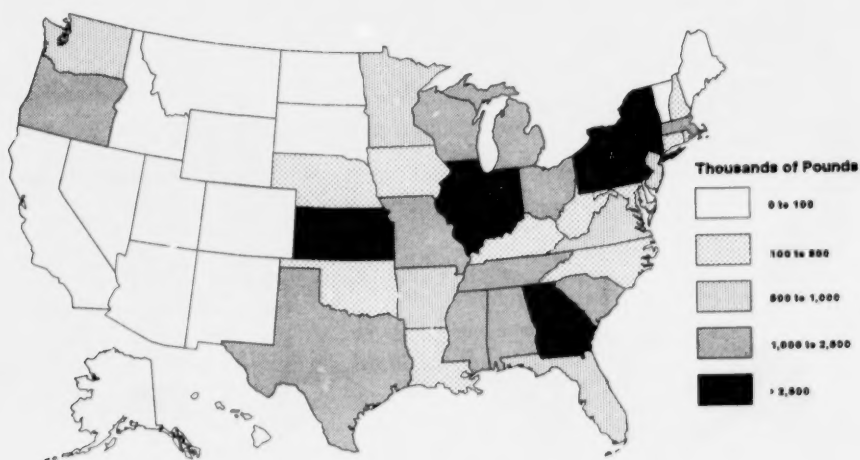
² All six NESHAP chemicals are on the list of TRI chemicals. Three of the six—arsenic, beryllium, and mercury—are included a second time as TRI chemical categories. Thus, six NESHAP chemicals are represented by nine different TRI chemicals and chemical categories.

EPA has also set National Ambient Air Quality Standards (NAAQS) under the 1970 Clean Air Act Amendments for six pollutants: lead; oxides of nitrogen; ozone; carbon monoxide; sulfur dioxide; and total suspended particulates. Of the six, lead (and lead compounds) are included on the TRI chemical list. In 1987, total TRI air emissions for lead and lead compounds were 2,487,013 pounds; fugitive emissions were 773,519 pounds, and point source emissions were 1,713,494. (See Chapter 12 for further discussion of lead and lead compounds.)

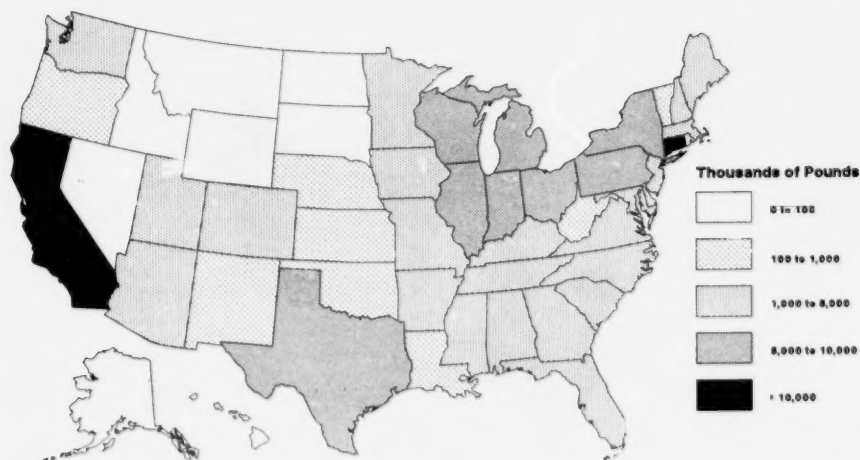
Selected Chemicals

Total TRI air emissions of the individual chemicals trichloroethylene and 1,1,1-trichloroethane show similar geographic distributions to the total TRI releases and transfers (compare Maps 6-3 and 6-4 to Maps 5-4 and 5-5). The geographical distribution of ammonia, the TRI chemical with the highest reported air emissions, shows concentrations in Ohio and Louisiana and throughout the South and Midwest (Map 6-5).

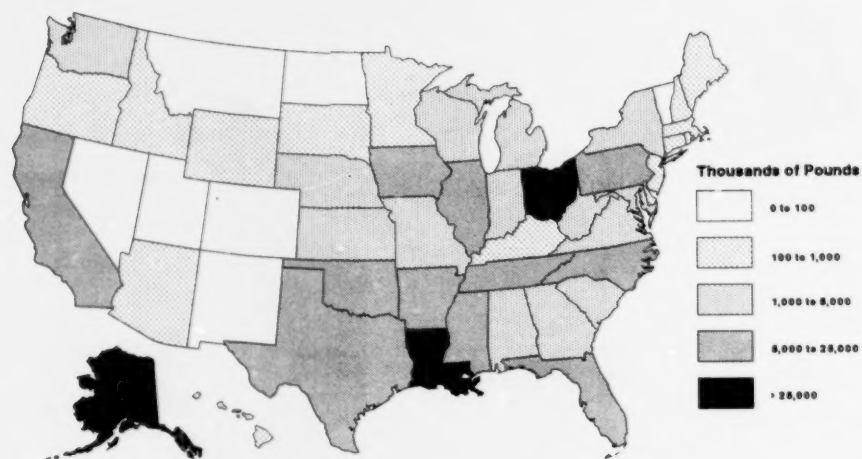
Total air emissions of benzene, the NESHAP chemical with the largest amount of air emissions, shows a similar geographic distribution with the greatest concentrations in Texas and states near the Great Lakes (Map 6-6). Two other maps, for chlorine air emissions (Map 6-7) and metal and metal compounds (Map 6-8) show that other states (Utah for chlorine and Washington for metals) also had relatively larger air emissions of selected chemicals.



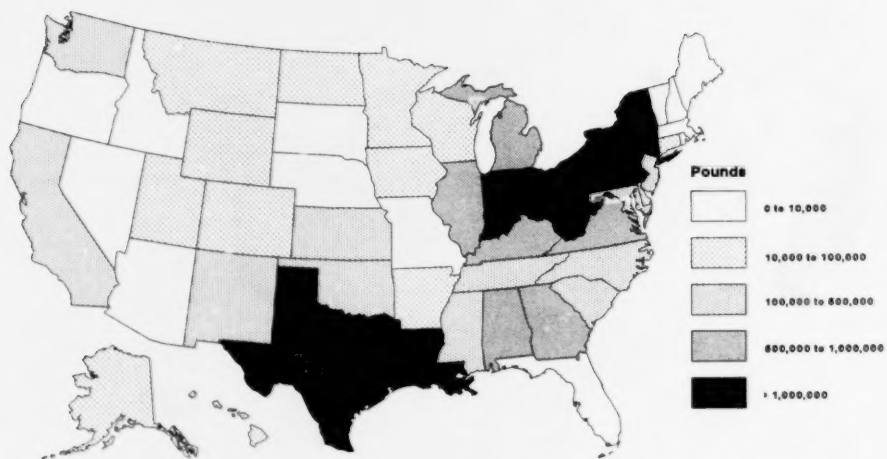
Map 6-3
Total Air Emissions of Trichloroethylene Reported to TRI, 1987.



Map 6-4.
Total Air Emissions of 1,1,1-Trichloroethane Reported to TRI, 1987.



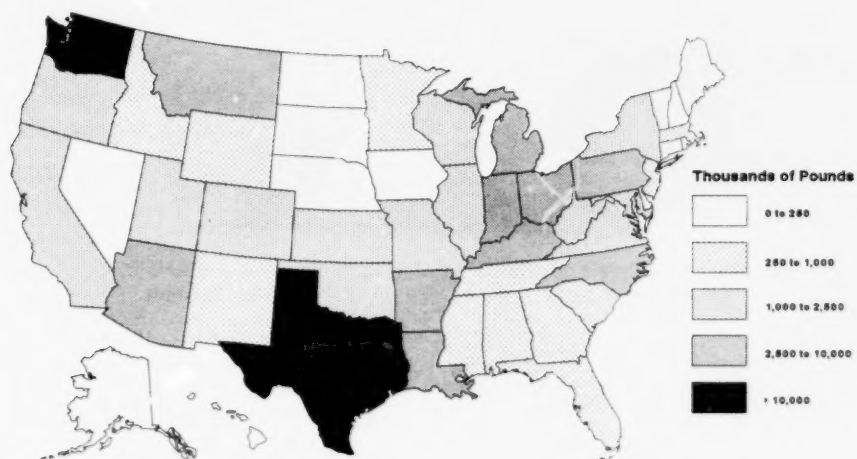
Map 6-5.
Total Air Emissions of Ammonia Reported to TRI, 1987.



Map 6-6.
Total Air Emissions of Benzene Reported to TRI, 1987.



Map 6-7.
Total Air Emissions of Chlorine Reported to TRI, 1987.



Map 6-8.
Total Air Emissions of Metals and Metal Compounds Reported to TRI, 1987.

Basis of Estimate for Air Emissions

Two-thirds of TRI air emissions were based on calculations or estimates; less than nine percent were measured.

Facilities reported whether their air emissions data were based on measurements, calculations, published emissions factors, or other methods. Nearly 30 percent of the TRI totals for both point source and fugitive air emission were arrived at by calculations (Figure 6-7). "Measured" emissions differed significantly between point source (12 percent) and fugitive emissions (4 percent). In addition, the use of "emissions factors" for fugitive emissions (12 percent) was double that for point source emissions (6 percent).

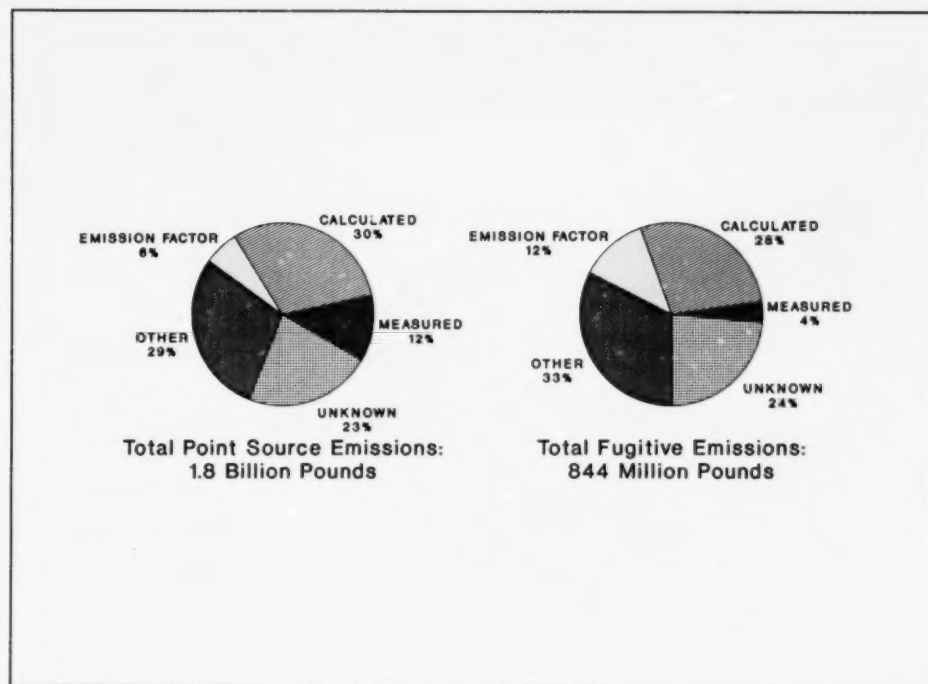


Figure 6-7.
Basis of Estimate for Air Emissions Reported to TRI, 1987.



Chapter 7. Discharges To Water

Introduction

Under the Toxics Release Inventory (TRI), facilities reported discharges of toxic chemicals to surface water, such as rivers, lakes, ponds, and streams, as well as transfers of toxic chemicals to public sewage systems.¹ Reported **discharges to surface waters** were dominated by discharges of a single chemical—sodium sulfate. For surface water discharges, sodium sulfate represented 94 percent of all reported discharges. For **transfers to public sewage systems**, sodium sulfate was 54 percent of the reported transfers.

Sodium sulfate accounted for 94 percent of TRI surface water discharges and 54 percent of transfers to public sewage systems.

This chapter discusses the type and amount of TRI chemicals that facilities discharged to surface water or transferred to public sewage treatment plants, and which industries and facilities discharged TRI chemicals. Throughout, the distinction between *discharges to surface waters* and *transfers to public sewage treatment plants*² must be recognized. In both cases, chemicals leave a facility as part of a wastewater stream, but they follow two entirely different paths into the environment. TRI reports do not determine the actual amount of TRI chemicals released to the environment as a result of transfers to public sewage systems, and where those chemicals eventually end up—water, land, or air.

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- ¹ Some TRI wastewater discharges are not covered in this chapter: wastewaters released by underground injection (see Chapter 8); and transfers of wastewater to off-site facilities other than public sewage treatment plants (see Chapter 9).
 - ² Although chemicals transferred to public sewage systems are not released directly to surface waters, they may pass through or interfere with sewage or wastewater treatment plants, with the result that the chemicals can reach surface waters. In general, sewage treatment plants remove between 40 and 90 percent of chemicals pollutants from water, although in some cases these chemicals are transferred to other segments of the environment in the form of air emissions or as sewage sludge.

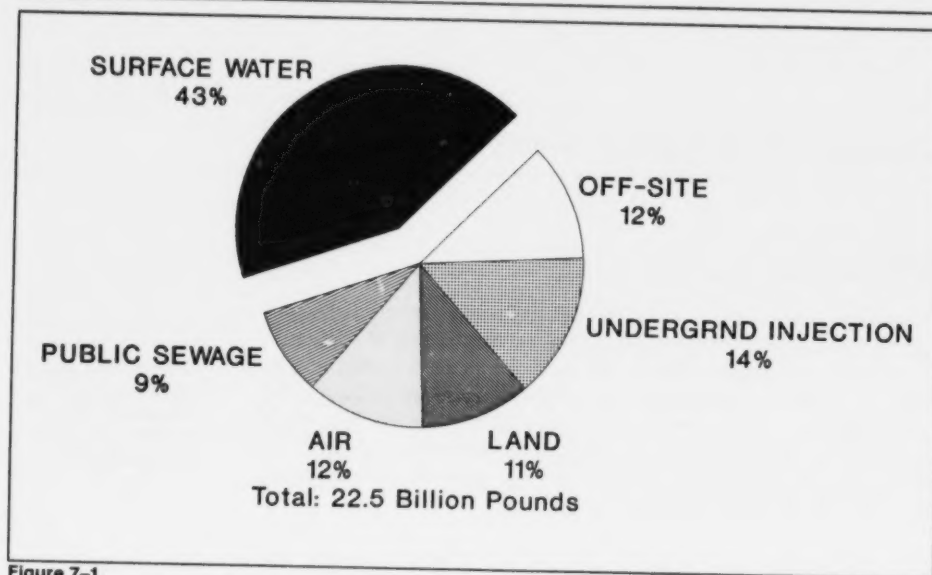


Figure 7-1.
Discharges to Surface Water as a Proportion of TRI Total Releases and Transfers, 1987.

DISCHARGES TO SURFACE WATER

Facilities discharged over 9.6 billion pounds of TRI chemicals to surface water in 1987.

Facilities discharged larger amounts of TRI chemicals to surface water than to land or air in 1987. Discharges to surface water accounted for 43 percent (9.6 billion pounds) of total TRI chemical releases and transfers (Figure 7-1). Despite the dominance of surface water discharges, they were not frequently reported—only 15 percent of all TRI facilities (2,663 facilities) reported surface water discharges in 14 percent of TRI chemical forms (8,851 forms)—suggesting that the facilities which did discharge TRI chemicals to surface water did so in relatively larger amounts than to air or to land.

Sodium sulfate was a major component of discharges to surface water, accounting for almost 94 percent of the total. Without sodium sulfate,³ surface water discharges would comprise a much smaller fraction of total TRI releases and transfers. The influence of sodium sulfate is discussed in detail throughout this chapter.

³ EPA has recommended removing sodium sulfate from the TRI chemical list (see Chapter 4, Box 4-A).

Geographical Distribution of Discharges to Surface Water

States

Facilities in the Southeast and on the West Coast discharged the largest amount of chemicals to surface water (Map 7-1, Table 7-1). California facilities reported the largest amounts, discharging 3.8 billion pounds of TRI chemicals into surface water — 40 percent of all discharges to surface water.

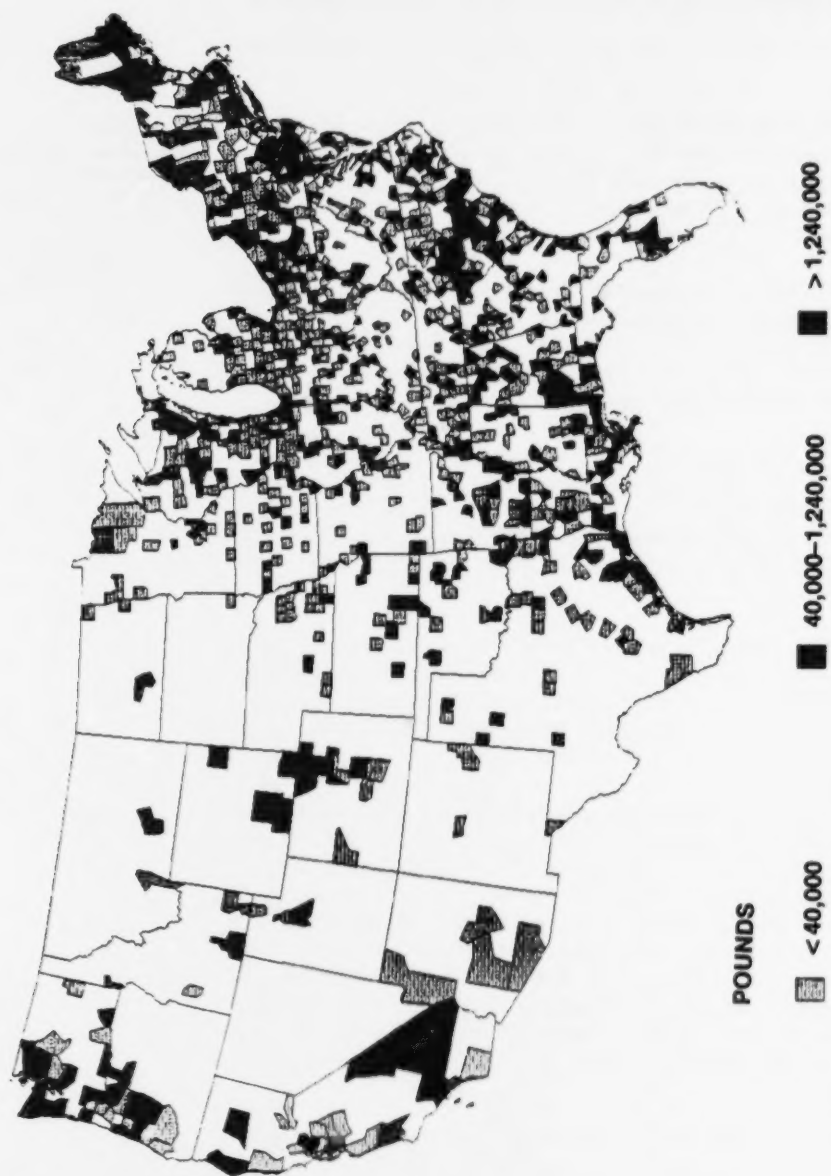
Within California, 97 percent (3.7 billion pounds) of all TRI surface water discharges consisted of sodium sulfate discharged by a single facility in Trona, California. Without sodium sulfate, however, the distribution of surface water discharges differs significantly — California would rank ninth rather than first. See Chapter 5, Box 5-B.

Louisiana facilities discharged the second largest amount of TRI chemicals to surface water, with discharges totaling 776 million pounds. Eight other states each released over 200 million pounds of chemicals to surface water. These top ten states accounted for 82 percent (7.8 billion pounds) of all discharges to surface water (Figure 7-2).

Facilities in Nevada did not report any discharges to surface water; seven other states each had less than one million pounds of such discharges (Table 7-1). Discharges from these lowest-ranking eight jurisdictions represented less than 0.02 percent of the total discharges to surface water.

Discharges to surface water accounted for more than 70 percent of total TRI releases and transfers in five states — Maine (89 percent), Washington (75 percent), Mississippi (72 percent), Georgia (72 percent), and the Virgin Islands (71 percent) — and for more than 50 percent of all TRI releases and transfers in 12 additional states. In contrast, facilities in 15 jurisdictions discharged less than ten percent of their total TRI releases and transfers to surface water; in five of those jurisdictions, they discharged less than one percent of their total TRI releases and transfers to surface water: Nevada, Arizona, New Mexico, Utah, and South Dakota. (See Table 5-2.)

Facilities in the Southeast and on the West Coast reported the largest discharges of TRI chemicals to surface water; California facilities lead the nation.



Map 7-1. Total Discharges of TRI Chemicals to Surface Water Reported Nationwide, by County, 1987.

TABLE 7-1. TRI FACILITIES, FORMS AND DISCHARGES TO SURFACE WATER BY STATE, 1987

TRI SURFACE WATER DISCHARGE Rank	STATE	TRI FACILITIES REPORTING SURFACE WATER DISCHARGES		TRI FORMS REPORTING SURFACE WATER RELEASES		TRI RELEASES TO SURFACE WATER	
		Number	Percent	Number	Percent	Pounds	Percent
4	Alabama	85	3.19	321	3.63	533,895,407	5.55
38	Alaska	5	0.19	22	0.25	5,221,865	0.05
49	American Samoa	1	0.04	1	0.01	15,750	0.00
52	Arizona	5	0.19	12	0.14	3,000	0.00
13	Arkansas	43	1.61	123	1.39	171,220,328	1.78
1	California	110	4.13	316	3.57	3,834,808,964	39.88
40	Colorado	14	0.53	41	0.46	3,325,009	0.03
31	Connecticut	78	2.93	259	2.93	25,225,312	0.26
30	Delaware	18	0.68	53	0.60	29,852,685	0.31
15	Florida	41	1.54	96	1.08	107,593,997	1.12
6	Georgia	90	3.38	209	2.36	473,508,462	4.92
42	Hawaii	4	0.15	14	0.16	2,542,000	0.03
25	Idaho	6	0.23	17	0.19	50,737,549	0.53
29	Illinois	118	4.43	343	3.88	33,437,606	0.35
16	Indiana	78	2.93	224	2.53	105,987,418	1.10
34	Iowa	37	1.39	105	1.19	15,335,547	0.16
36	Kansas	20	0.75	88	0.97	7,578,737	0.08
18	Kentucky	54	2.03	244	2.76	76,889,713	0.80
2	Louisiana	105	3.94	614	6.94	775,838,211	8.07
12	Maine	24	0.90	80	0.90	195,803,966	2.04
14	Maryland	28	1.05	108	1.20	111,795,540	1.16
43	Massachusetts	46	1.73	117	1.32	2,118,295	0.02
27	Michigan	94	3.53	283	3.20	38,127,898	0.40
33	Minnesota	30	1.13	111	1.25	15,826,354	0.16
5	Mississippi	46	1.73	160	1.81	473,882,098	4.93
28	Missouri	46	1.73	146	1.65	38,408,436	0.38
46	Montana	5	0.19	30	0.34	791,946	0.01
41	Nebraska	30	1.13	50	0.56	2,754,398	0.03
53	Nevada	0	0.00	0	0.00	0	0.00
26	New Hampshire	10	0.38	21	0.24	42,428,961	0.44
24	New Jersey	93	3.49	310	3.50	55,063,498	0.57
50	New Mexico	2	0.08	3	0.03	9,057	0.00
23	New York	130	4.88	429	4.84	56,110,261	0.58
10	North Carolina	105	3.94	298	3.37	217,090,591	2.26
47	North Dakota	3	0.11	3	0.03	393,600	0.00
19	Ohio	184	6.91	565	6.38	68,219,055	0.71
20	Oklahoma	15	0.56	73	0.82	85,792,624	0.88
21	Oregon	32	1.20	86	0.97	83,362,600	0.86
22	Pennsylvania	194	7.29	601	6.79	61,601,577	0.64
44	Puerto Rico	21	0.79	72	0.81	1,678,734	0.02
35	Rhode Island	14	0.53	49	0.55	13,187,892	0.14
7	South Carolina	88	3.30	323	3.65	340,939,102	3.55
51	South Dakota	1	0.04	2	0.02	3,698	0.00
11	Tennessee	72	2.70	238	2.67	196,399,204	2.04
3	Texas	168	6.31	725	8.19	659,657,602	6.86
48	Utah	9	0.34	32	0.36	133,749	0.00
45	Vermont	7	0.26	17	0.19	1,113,799	0.01
37	Virgin Islands	1	0.04	14	0.16	5,303,250	0.06
9	Virginia	56	2.10	170	1.92	225,383,321	2.34
8	Washington	56	2.10	182	2.06	303,664,767	3.16
17	West Virginia	39	1.46	212	2.40	87,295,714	0.91
32	Wisconsin	99	3.72	231	2.61	16,563,741	0.17
39	Wyoming	3	0.11	15	0.17	3,460,037	0.04
TOTAL		2,663	100.00	8,851	100.00	9,615,673,925	100.00
PERCENT OF ALL REPORTING		13.61		11.94		42.70	

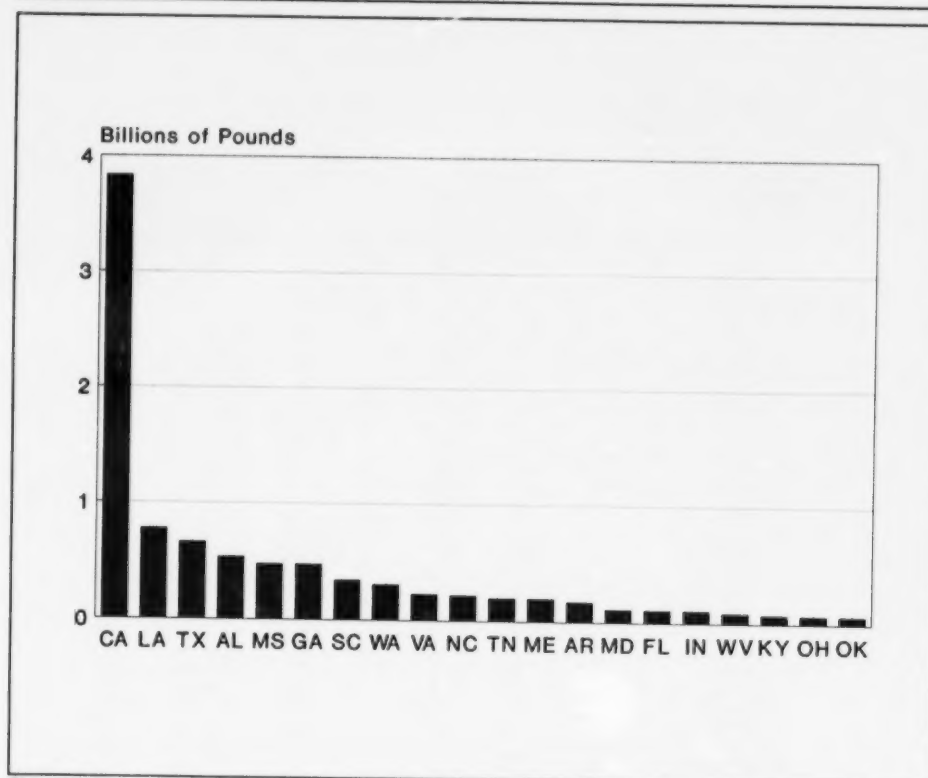


Figure 7-2.

The 20 States with the Largest Discharges to Surface Water, 1987.

TRI surface water discharges in 25 counties accounted for over two thirds of the total for the nation.

Counties

The 25 counties with the largest surface water discharges of TRI chemicals accounted for over two-thirds of the nation's total TRI discharges to surface water (Table 7-2). Discharges in San Bernardino County, California, the location of the facility that discharged 3.7 billion pounds of sodium sulfate, comprised 38 percent of all surface water discharges of TRI chemicals. Without this single release, facilities in San Bernardino County would have reported 1.1 million pounds only of discharges to surface water.

Some states had large surface water discharges of TRI chemicals in several counties. Facilities in each of six Louisiana parishes discharged more than 50 million pounds of TRI chemicals into surface waters, thus ranking the six parishes among the top counties (or parishes) for

surface water discharge. Surface waters in these six parishes received 80 percent (620 million pounds) of Louisiana's total surface water discharges of TRI chemicals. Other states with several top 25 counties were Georgia (4 counties), Texas (3 counties), and Alabama (3 counties).

Facilities in six Louisiana parishes discharged more than 50 million pounds of TRI chemicals to surface water.

In some states, surface water discharges of TRI chemicals in a single county accounted for most of the state's total. For example, the 3.7 billion pounds of TRI chemicals discharged to surface water in San Bernardino County made up 96 percent of California's total surface water discharges. Similarly, the 370 million pounds discharged to surface water in Harrison County, Mississippi constituted 78 percent of the total releases to surface water in that state.

TABLE 7-2. THE 25 COUNTIES WITH THE LARGEST TRI DISCHARGES TO SURFACE WATERS, 1987

COUNTY	STATE	TRI SURFACE WATER DISCHARGES Pounds	PERCENT OF SURFACE WATER DISCHARGES IN THE STATE
SAN BERNARDINO	CA	3,698,590,507	96.45
HARRISON	MS	369,928,087	78.06
HARRIS	TX	295,563,279	44.81
MOBILE	AL	187,856,883	35.19
BRAZORIA	TX	186,700,897	28.30
CHARLESTON	SC	174,946,450	51.31
ST JAMES	LA	172,810,740	22.27
EAST BATON ROUGE	LA	137,177,733	17.68
COWLITZ	WA	129,984,181	42.80
ANNE ARUNDEL	MD	106,957,137	95.67
CALCASIEU	LA	94,952,372	12.24
WAYNE	GA	93,196,361	19.68
FLOYD	GA	82,003,719	17.32
WARREN	VA	80,137,150	35.56
GLYNN	GA	78,040,088	16.48
ASCENSION	LA	77,873,065	10.04
CHATHAM	GA	75,916,582	16.03
LITTLE RIVER	AR	71,031,000	41.49
BEAUREGARD	LA	70,266,100	9.06
IBERVILLE	LA	66,646,126	8.59
MARTIN	NC	65,052,372	29.97
MC CURTAIN	OK	57,069,900	86.74
AUTAUGA	AL	57,015,100	10.68
TALLADEGA	AL	56,818,459	10.64
JEFFERSON	TX	54,816,432	8.31
SUBTOTAL		6,541,350,720	
PERCENT OF GRAND TOTAL		68.03	
TOTAL FOR ALL OTHERS		3,074,323,205	
GRAND TOTAL		9,615,673,925	

Industries Discharging TRI Chemicals to Surface Water

Industrial Distribution

The Chemical and Paper Industries discharged 83 percent of the total TRI surface water discharges.

The Chemical and Allied Products and the Paper and Allied Products industries each discharged more than two billion pounds of TRI chemicals directly to surface water, accounting for 83 percent of the total TRI surface water discharges (Figure 7-3, Table 7-3).⁴ The Chemical industry discharged 5.8 billion pounds (61 percent of the nation's surface water discharges) and the Paper industry discharged 2.1 billion pounds (22 percent of the total). Facilities in each of three additional industries—Petroleum Refining and Related Industries, Textile Mill Products, and Primary Metals Industry—discharged more than 100 million pounds of TRI chemicals to surface water. The surface water discharges of TRI chemicals from these five industries comprised 90 percent of all such discharges.

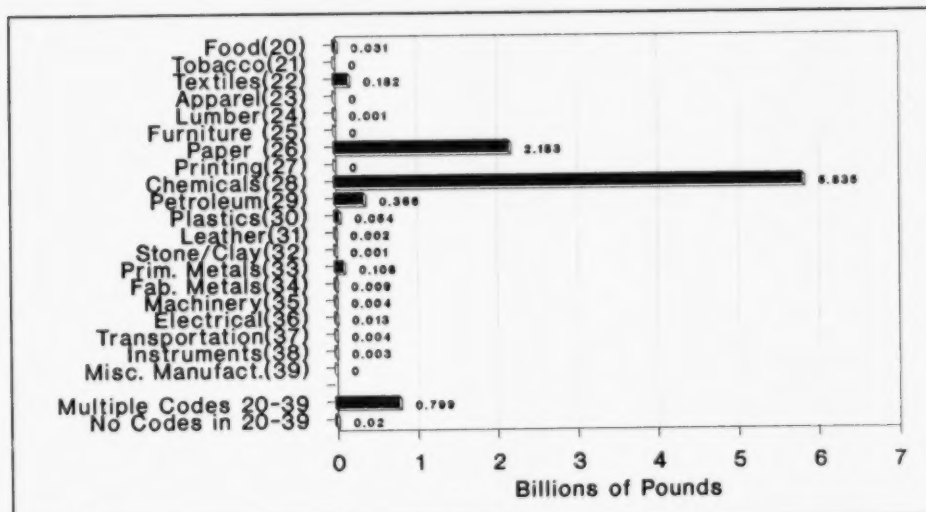


Figure 7-3.
Discharges of TRI Chemicals to Surface Water by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

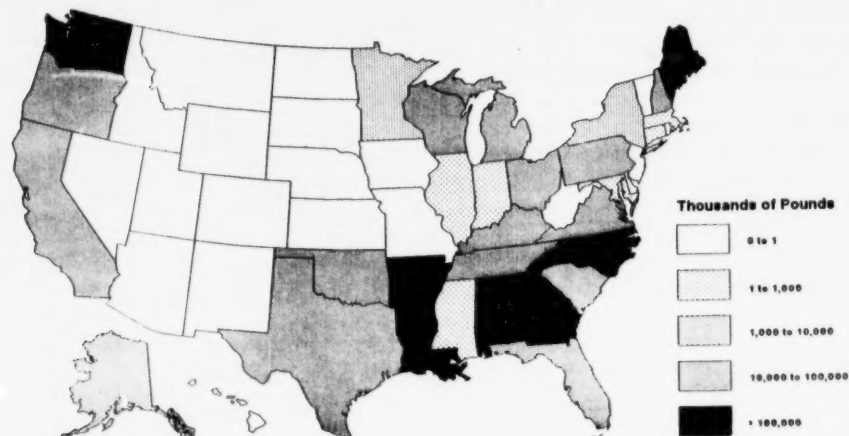
4 See Appendix C for a list of industries covered by TRI reporting requirements.

The industries reporting the smallest surface water discharges were Printing, Publishing and Allied Industries; Apparel, Furniture and Fixtures; Tobacco; and Miscellaneous Manufacturing. These five industry groups discharged only 0.005 percent of the total amount of TRI chemicals released to surface water.

Surface water discharges of TRI chemicals for particular industries were concentrated in different geographical areas than TRI discharges from all industries combined. For example, surface water discharges from facilities in the Paper industry were prominent in the Southeast, the Gulf Coast, Maine, and Washington (Map 7-2). Comparing this map with the map of total TRI releases and transfers (Map 5-1) shows that many of the same areas of the country have high totals

TABLE 7-3. TRI FACILITIES, FORMS, AND DISCHARGES TO SURFACE WATER, 1987

TRI SURFACE WATER DISCHARGE	SIC CODE	INDUSTRY	TRI FACILITIES WITH SURFACE WATER DISCHARGES		TRI FORMS WITH SURFACE WATER DISCHARGES		TRI SURFACE WATER DISCHARGES	
			Number	Percent	Number	Percent	Pounds	Percent
8	20	Food Products	169	6.35	255	2.88	30,560,639	0.32
19	21	Tobacco Manufacturers	3	0.11	7	0.08	132,545	0.00
5	22	Textile Mill Products	83	3.12	209	2.36	182,363,632	1.90
21	23	Apparel	2	0.08	2	0.02	42,810	0.00
17	24	Lumber and Wood Products	54	2.03	121	1.37	1,001,064	0.01
20	25	Furniture and Fixtures	8	0.30	24	0.27	47,984	0.00
2	26	Paper Products	214	8.04	593	6.70	2,183,493,703	22.71
22	27	Printing, Publishing	5	0.19	11	0.12	3,521	0.00
1	28	Chemical Products	732	27.49	3,259	36.82	5,835,403,944	60.69
4	29	Petroleum Refining	133	4.99	876	9.90	366,051,900	3.81
7	30	Rubber and Plastic Products	68	2.55	108	1.22	54,077,618	0.56
15	31	Leather Products	12	0.45	21	0.24	1,959,658	0.02
16	32	Stone, Clay, Glass Products	86	3.23	144	1.63	1,322,017	0.01
6	33	Primary Metals	305	11.45	1,053	11.90	105,944,217	1.10
11	34	Fabricated Metals	195	7.32	474	5.36	9,079,259	0.09
12	35	Machinery, except Electrical	50	1.88	133	1.50	4,439,271	0.05
10	36	Electric and Electronic Equip.	142	5.33	373	4.21	13,060,342	0.14
13	37	Transportation Equipment	74	2.78	196	2.21	3,878,314	0.04
14	38	Measuring, Photographic Goods	22	0.83	83	0.94	3,153,101	0.03
18	39	Misc. Manufacturing	24	0.90	69	0.78	264,802	0.00
3		Multiple SIC codes in 20 - 39	242	9.09	759	8.58	799,136,129	8.31
9		No SIC codes in 20 - 39	40	1.50	81	0.92	20,237,455	0.21
TOTAL			2,663	100.00	8,851	100.00	9,615,673,925	100.00
PERCENT OF ALL REPORTING			13.81		11.94		42.70	



Map 7-2.
Discharges of TRI Chemicals to Surface Water by the Paper Industry, 1987.

on both maps. This is because discharges to surface waters represent a large portion (43 percent) of the total TRI releases and transfers. The exception is the area near the Great Lakes, where TRI totals are relatively high but discharges to surface waters are not.

Industrial Activities and Uses

Facilities engaged in *manufacture only* filed 18 percent of all chemical-specific forms reporting discharges of TRI chemicals to surface water (1,620 forms), but these manufacturers discharged 77 percent (7.4 billion pounds) of the total amount of TRI chemicals discharged to surface water (Figure 7-4). Facilities that reported *processing only* submitted 23 percent of TRI chemical forms reporting surface water discharges, but accounted for only two percent of the total amount of TRI chemicals discharged. Likewise, facilities reporting *other uses* of TRI chemicals filed 30 percent of the forms, but discharged only two percent of the total amount of TRI chemicals to surface waters. Approximately 27 percent of the chemical forms reporting discharges to surface water were from facilities that identified *combined uses* of TRI chemicals; these facilities accounted for 19 percent of the total direct discharges to surface water.

Facilities engaged in only manufacturing activities discharged over three-quarters of all TRI surface water discharges.

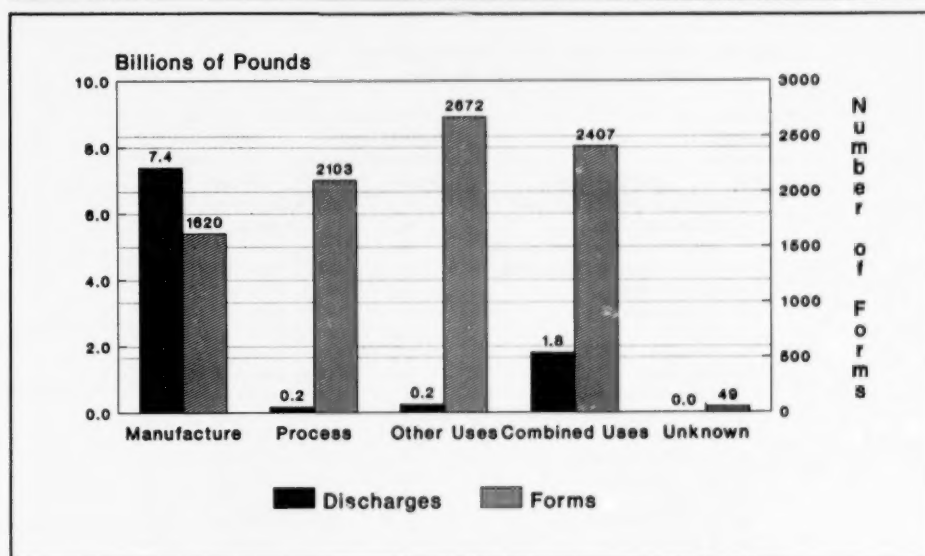


Figure 7-4.
Distribution of Discharges of TRI Chemicals to Surface Water by Activity and Use, 1987.

Chemicals Discharged to Surface Water

Twenty-five TRI chemicals accounted for 99.9 percent (9.6 billion pounds) of the total reported discharges of TRI chemicals to surface water. Sodium sulfate alone accounted for 94 percent (9.1 billion pounds) of the total. Six other TRI chemicals were discharged in amounts larger than 30 million pounds each, making up five percent (443 million pounds) of the total TRI discharges to surface waters. Together these seven chemicals accounted for 99 percent (9.5 billion pounds) of the TRI chemicals discharged to surface water. (The overwhelming role of sodium sulfate, compared to other chemicals in direct discharges to surface water is further examined in Box 7-A, page 109.)

Sodium sulfate made up 94 percent of the TRI surface water discharges.

Nine of the top ten TRI chemicals discharged to surface water also ranked in the top ten for total TRI releases and transfers. Several of the chemicals that ranked in the top 25 for direct releases to surface water, however, ranked much lower for total TRI releases and transfers (Table 7-4). Melamine, for example, ranked 21st for surface water discharges, but 114th for total TRI releases and transfers.

TABLE 7-4. THE 25 TRI CHEMICALS WITH THE LARGEST SURFACE WATER DISCHARGES, 1987

TOTAL TRI RELEASES/ TRANSFERS	CHEMICAL NAME	TRI FORMS WITH SURFACE WATER DISCHARGES		TRI SURFACE WATER DISCHARGES	
		Number	Percent	Pounds	Percent
1	SODIUM SULFATE (SOLUTION)	611	6.90	9,061,039,211	94.23
10	PHOSPHORIC ACID	126	1.42	126,832,077	1.34
3	AMMONIUM SULFATE (SOLUTION)	69	0.78	90,169,835	0.94
6	SODIUM HYDROXIDE (SOLUTION)	515	5.82	78,730,126	0.82
5	SULFURIC ACID	343	3.88	77,533,817	0.81
2	ALUMINUM OXIDE	152	1.72	36,101,026	0.38
7	AMMONIA	525	5.93	31,641,355	0.33
8	METHANOL	194	2.19	24,909,084	0.26
22	NITRIC ACID	114	1.29	16,642,456	0.17
4	HYDROCHLORIC ACID	177	2.00	13,674,536	0.14
20	AMMONIUM NITRATE (SOLUTION)	59	0.67	11,716,299	0.12
19	CHLORINE	381	4.30	10,975,651	0.11
49	ARSENIC COMPOUNDS	13	0.15	10,468,669	0.11
30	ETHYLENE GLYCOL	184	2.06	4,251,579	0.04
11	ACETONE	194	2.19	2,032,678	0.02
18	ZINC COMPOUNDS	259	2.93	1,630,598	0.02
48	FORMALDEHYDE	123	1.39	1,610,841	0.02
45	CHLOROFORM	108	1.22	1,361,257	0.01
33	METHYL ISOBUTYL KETONE	33	0.37	1,116,924	0.01
21	MANGANESE COMPOUNDS	69	0.78	669,597	0.01
114	MELAMINE	10	0.11	537,048	0.01
34	TOTAL FOR MIXTURES	16	0.18	507,704	0.01
12	XYLENE (MIXED ISOMERS)	182	2.06	473,529	0.00
23	ZINC (FUME OR DUST)	116	1.31	454,434	0.00
66	1,3-BUTADIENE	17	0.19	432,668	0.00
SUBTOTAL		4,590	51.86	9,607,513,198	99.92
TOTAL FOR ALL OTHERS		4,261	48.14	8,160,727	0.08
GRAND TOTAL		8,851	100.00	9,615,673,925	100.00

Of the 272 chemicals for which TRI releases or transfers were reported, 217 (80 percent) were discharged to surface water in some amount. Facilities did not report any surface water discharges of 55 (20 percent) of the TRI chemicals (Table 7-5).

TABLE 7-5. TRI CHEMICALS WITH NO REPORTED SURFACE
WATER DISCHARGES, 1987
(Of the 272 chemicals for which some releases were reported)

1	1,1-DIMETHYL HYDRAZINE
2	2,4-DIAMINOANISOLE
3	2,6-XYLIDINE
4	4,4'-METHYLENEBIS(2-CHLORO ANILINE)
5	4,4'-METHYLENEBIS(N,N-DIMETHYL)
6	4-AMINOAZOBENZENE
7	4-AMINOBIPHENYL
8	4-NITROPHENOL
9	5-NITRO-O-ANISIDINE
10	ACETAMIDE
11	ALPHA-NAPHTHYLAMINE
12	BENZAL CHLORIDE
13	BENZOIC TRICHLORIDE
14	BENZOYL CHLORIDE
15	BIS(CHLOROMETHYL) ETHER
16	BROMOMETHANE
17	CALCIUM CYANAMIDE
18	CAPTAN
19	CHLORAMBEN
20	CHLOROBENZILATE
21	CHLOROMETHYL METHYL ETHER
22	C.I. ACID BLUE 9, DIAMMONIUM SALT
23	C.I. ACID BLUE 9, DISODIUM SALT
24	C.I. BASIC GREEN 4
25	C.I. SOLVENT YELLOW 14
26	DICHLOROBROMOMETHANE
27	DICHLORVOS
28	DICOFOL
29	ETHYL CHLOROFORMATE
30	ETHYLENE THIOUREA
31	ETHYLENEIMINE
32	FLUOMETURON
33	HYDRAZINE SULFATE
34	MANEB
35	METHYL HYDRAZINE
36	METHYL IODIDE
37	METHYL ISOCYANATE
38	MICHLER'S KETONE
39	M-CRESOL
40	NITROGEN MUSTARD
41	N-NITROSODIPHENYLAMINE
42	POLY BROMINATED BIPHENYLS
43	PROPANE SULTONE
44	PROPOXUR
45	PROPYLENEIMINE
46	P-NITROSODIPHENYLAMINE
47	QUINTOZENE
48	SACCHARIN (MANUFACTURING)
49	SAFROLE
50	TETRACHLORVINPHOS
51	THALLIUM COMPOUNDS
52	THORIUM DIOXIDE
53	TRICHLORFON
54	VINYL BROMIDE
55	ZINEB

TABLE 7-6. TRI SURFACE WATER DISCHARGES
BY CHEMICAL CLASS, 1987

TOTAL TRI RELEASE/ TRANSFER Rank	CHEMICAL NAME	TRI SURFACE WATER DISCHARGES (pounds)	PERCENT OF TOTAL TRI SURFACE WATER DISCHARGES
<u>Acids/Bases/Salts</u>			
1	SODIUM SULFATE (SOLUTION)	9,061,039,211	94.23
3	AMMONIUM SULFATE (SOLUTION)	90,169,835	0.94
4	HYDROCHLORIC ACID	13,874,536	0.14
5	SULFURIC ACID	77,533,817	0.81
6	SODIUM HYDROXIDE (SOLUTION)	78,730,126	0.82
10	PHOSPHORIC ACID	128,832,077	1.34
	Subtotal	9,449,979,602	98.27
	TOTAL FOR ALL OTHERS IN CLASS	28,719,565	0.30
	TOTAL FOR CLASS	9,478,699,167	98.57
<u>Halo-organics</u>			
14	1,1,1-TRICHLOROETHANE	40,700	0.00
17	DICHLOROMETHANE	369,150	0.00
25	FREON 113	36,587	0.00
26	TRICHLOROETHYLENE	31,467	0.00
35	TETRACHLOROETHYLENE	154,971	0.00
	Subtotal	632,875	0.01
	TOTAL FOR ALL OTHERS IN CLASS	2,051,948	0.02
	TOTAL FOR CLASS	2,684,823	0.03
<u>Metals and Metal Compounds</u>			
2	ALUMINUM OXIDE	38,101,026	0.38
15	COPPER	278,053	0.00
16	ZINC COMPOUNDS	1,830,598	0.02
21	MANGANESE COMPOUNDS	869,597	0.01
23	ZINC (FUME OR DUST)	454,434	0.00
	Subtotal	39,131,708	0.41
	TOTAL FOR ALL OTHERS IN CLASS	2,054,265	0.02
	TOTAL FOR CLASS	41,185,973	0.43
<u>Non-metallic Inorganics</u>			
7	AMMONIA	31,641,355	0.33
19	CHLORINE	10,975,651	0.11
49	ARSENIC COMPOUNDS	10,468,869	0.11
50	ASBESTOS (FRIABLE)	20,129	0.00
57	CHLORINE DIOXIDE	7,965	0.00
	Subtotal	53,113,969	0.55
	TOTAL FOR ALL OTHERS IN CLASS	187,653	0.00
	TOTAL FOR CLASS	53,301,622	0.55
<u>Organics (non-halogenated)</u>			
8	METHANOL	24,909,084	0.26
9	TOLUENE	339,959	0.00
11	ACETONE	2,032,678	0.02
12	XYLENE (MIXED ISOMERS)	473,529	0.00
13	METHYL ETHYL KETONE	75,691	0.00
	Subtotal	27,830,941	0.29
	TOTAL FOR ALL OTHERS IN CLASS	11,452,275	0.12
	TOTAL FOR CLASS	39,283,216	0.41
34	TOTAL FOR MIXTURES	507,704	0.01
100	TOTAL FOR TRADE SECRETS	11,420	0.00
	GRAND TOTAL	9,615,673,925	100.00

Chemical Classes

The acids/bases/salts class, which includes sodium sulfate, accounted for 98.6 percent (9.5 billion pounds) of discharges of TRI chemicals to surface water (Table 7-6). The other chemical classes each accounted for less than one percent of surface water discharges of TRI chemicals. Without discharges of sodium sulfate, the acids/bases/salts class would account for 75 percent of discharges to surface water; the class of non-metallic organics would represent 10 percent with the two classes—metals and metal compounds and non-halogenated organics—both with about 7 percent.

Chemicals in the acids/bases/salts class, including sodium sulfate, accounted for nearly 99 percent of all TRI surface water discharges.

This 9.5 billion pounds of TRI surface water discharges accounted for over half (61 percent, 9.5 billion pounds) of the total releases and transfers of the acids/bases/salts category of TRI chemicals discharged to surface water (Figure 7-5). In contrast, discharges to surface water represented a very small percentage of the total TRI releases and transfers for each of the other chemical classes. The percentages are small enough that the surface water discharges are hardly visible for the other classes in Figure 7-5 due to the scale used to accommodate the large discharges of acids/bases/salts.

Over half of all TRI releases of acids/bases/salts went to surface water.

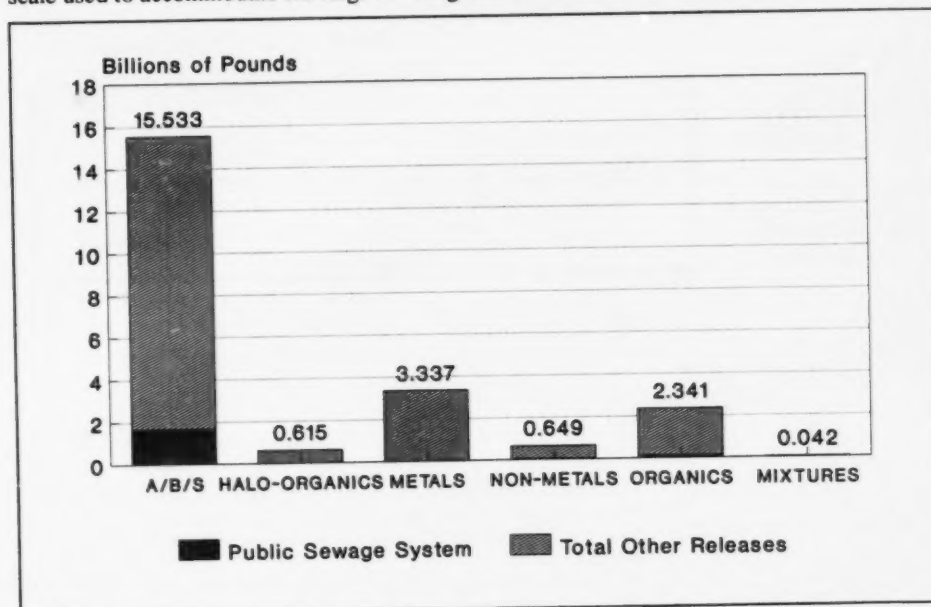


Figure 7-5. Discharges to Surface Water as a Proportion of Total TRI Releases and Transfers, 1987. (A/B/S = Acids/Bases/Salts.)

Discharges of Chemicals Regulated under the NPDES Program

Eighty-seven percent of the TRI chemical forms reporting surface water discharges (7,733 out of 8,851 forms, or 87 percent) listed discharges along with a permit under the National Pollutant Discharge Elimination System (NPDES).⁵ NPDES permits are issued to individual facilities under the authority of the Clean Water Act by EPA or states to control discharges of chemicals to surface waters. Facilities that reported NPDES permit numbers discharged 9.5 billion pounds of TRI chemicals to surface waters, which constitute 99 percent of all such discharges (Table 7-7).⁶ The remaining 90 million pounds (1 percent) of chemical discharges were reported on the 1,118 forms (13 percent of forms) that did not include NPDES permit numbers.

TABLE 7-7. TRI FACILITIES REPORTING NPDES PERMIT NUMBERS, 1987

	TRI TOTAL	TRI FORMS WITH A NPDES PERMIT NO.	TRI FORMS WITH NO NPDES PERMIT NO.
NUMBER OF TRI FORMS	8,851	7,733 (87 Percent of Total)	1,118
TOTAL TRI SURFACE WATER DISCHARGES (Pounds)	9.5 Billion	9.5 Billion (99 Percent of Total)	0.09 Billion

⁵ The permit numbers on 915 (12 percent) of these forms, however, may be invalid because they did not conform to the usual format for NPDES permit numbers. These 915 forms accounted for 41 percent (3.9 billion pounds) of direct releases to surface waters.

⁶ EPA has not yet cross-checked TRI and NPDES information. The fact that releases came from NPDES permit holders is no assurance that the releases are in accordance with permit conditions. EPA has begun to use TRI data as a screening tool to locate cases that need further examination.

Priority Pollutants

NPDES permits limit over 1500 types of pollutants. A subset of these contaminants (126) have been designated as **priority pollutants**. This set of toxic chemicals are included in technology-based standards that are used to establish permit limits where water quality standards are not being violated. Of the TRI chemicals and chemical categories, 94 are also priority pollutants. TRI facilities reported discharging a total of 43 million pounds of the 94 priority pollutants in 1987, or roughly 0.5 percent of the total TRI surface water discharges. Not counting sodium sulfate, however, discharges of priority pollutants would represent almost eight percent of all TRI discharges to surface water.

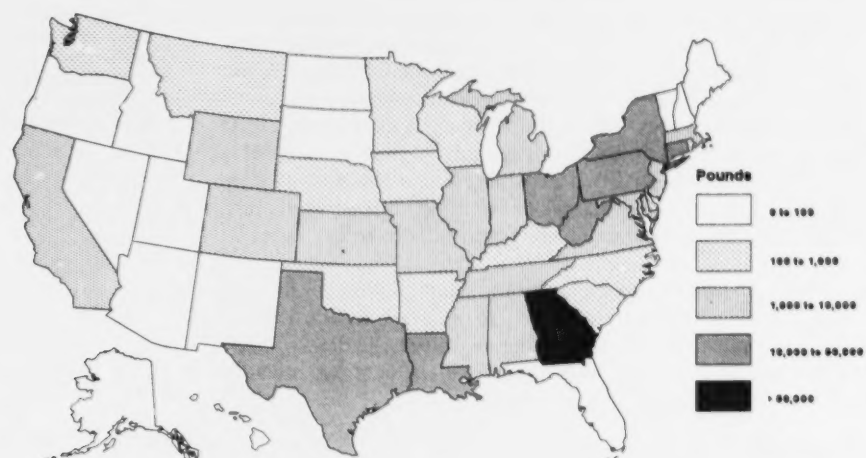
Ninety-four TRI chemicals are also designated as NPDES priority pollutants and are regulated accordingly.

The priority pollutants represent only a small portion of all toxic chemicals controlled under NPDES. In addition to controls on priority pollutants, NPDES permits may set other chemical-specific limits and they may be used to control whole-effluent toxicity after identification by biological toxicity testing.

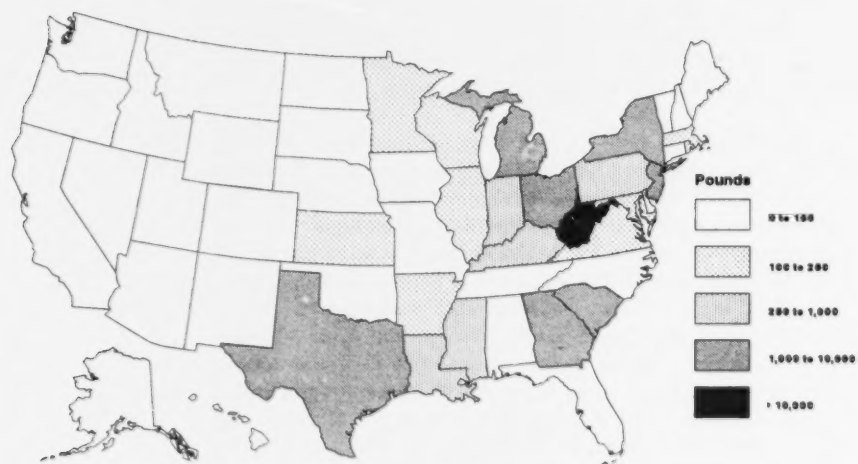
Selected Chemicals

Surface water discharges of individual TRI chemicals vary considerably across the nation. Maps 7-3, 7-4, 7-5, 7-6, 7-8, and 7-9 illustrate discharges to surface water for toluene, trichloroethylene, sodium sulfate, tetrachloroethylene, chromium, phenol, and metals and metal compounds. A comparison of the maps of toluene (Map 7-3) and trichloroethylene (Map 7-4) with those for all TRI releases and transfers for the same chemicals (see Chapter 5, Maps 5-3 and 5-4) shows that the individual states with the largest discharges of particular chemicals vary with the regions of the country.

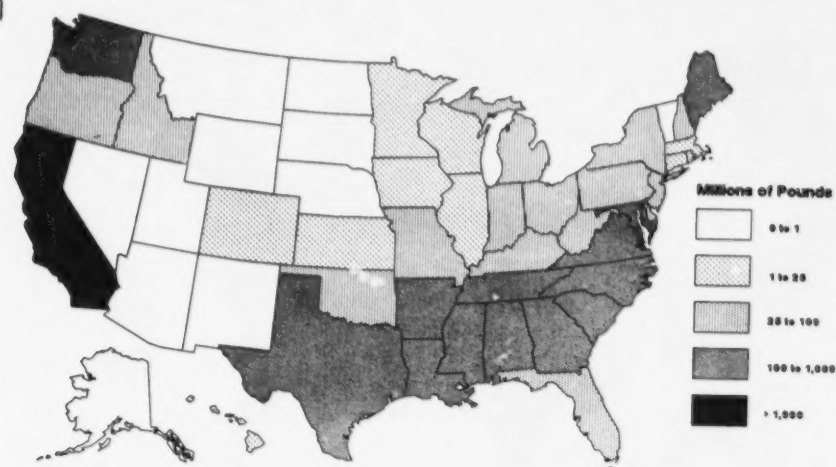
Sodium sulfate was discharged to surface water in the largest amounts in the West Coast and the East, with lower discharges in the Great Plains and Rocky Mountain areas. Tetrachloroethylene was also discharged to surface water in large amounts throughout the Great Lakes and the Mid-Atlantic states, the Midwest, Texas and Louisiana, but little was discharged to surface water in the West or the South. The largest surface water discharges of chromium were scattered across the country in the Northwest, Texas, Florida, and West Virginia. Phenol discharges to surface water, on the other hand, were concentrated in states near the Great Lakes as well as in Wyoming, Texas, and Louisiana (Map 7-8). Discharges to surface water of metals and metal compounds were found in the Great Lake States and on the West Coast as well as in Texas and Louisiana.



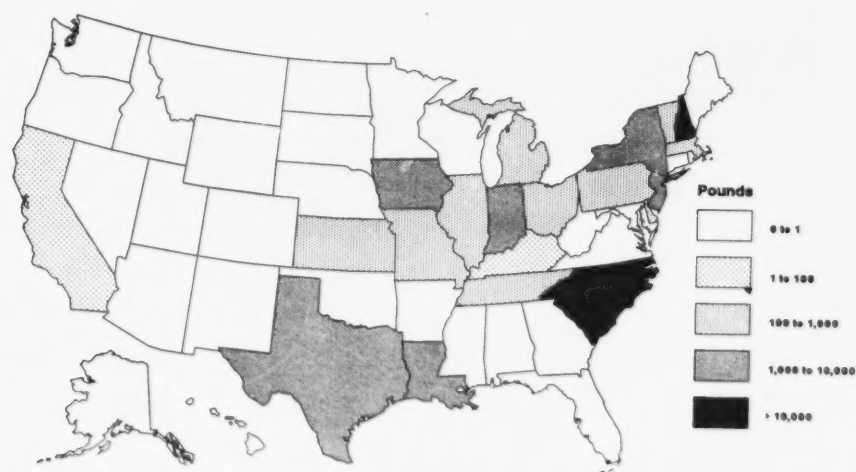
Map 7-3.
Discharges of Toluene to Surface Water Reported to TRI, 1987.



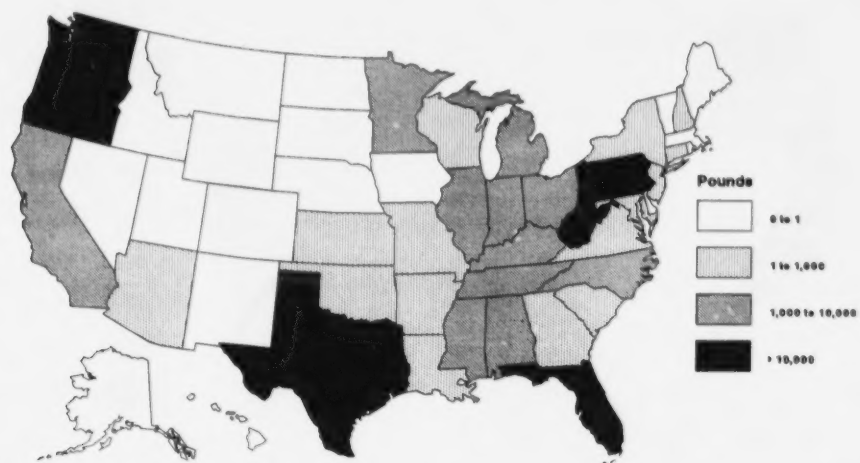
Map 7-4.
Discharges of Trichloroethylene to Surface Water Reported to TRI, 1987.



Map 7-5.
Discharges of Sodium Sulfate to Surface Water Reported to TRI, 1987.



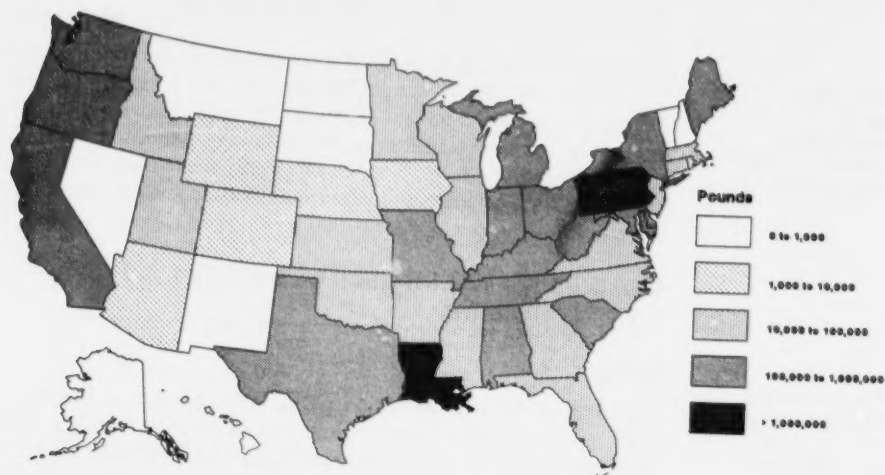
Map 7-6.
Discharges of Tetrachloroethylene to Surface Water Reported to TRI, 1987.



Map 7-7.
Discharges of Chromium to Surface Water Reported to TRI, 1987.



Map 7-8.
Discharges of Phenol to Surface Water Reported to TRI, 1987.



Map 7-9.
Discharges of Metals and Metal Compounds to Surface Water Reported to TRI, 1987.

Basis of Estimate for Discharges to Surface Water

Facilities calculated the TRI chemical amounts for over half of the total reported discharges to surface water (Figure 7-6), and measured 13 percent. Other methods were used to estimate 26 percent of all TRI surface water discharges, and emissions factors for one percent.

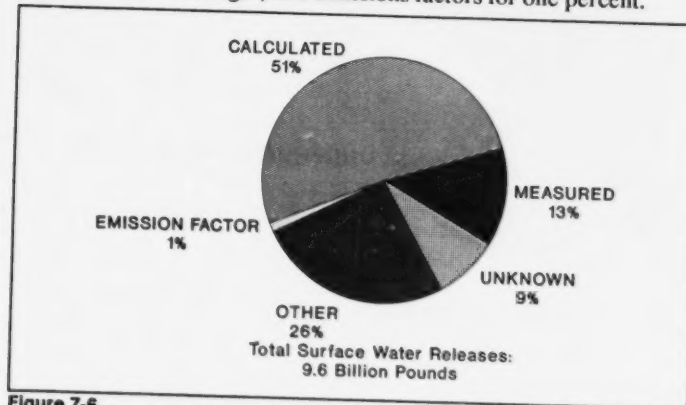


Figure 7-6.
Basis of Estimate for Discharges to Surface Water, 1987. Total surface water discharges: 9.6 billion pounds.

TRANSFERS TO PUBLIC SEWAGE SYSTEMS

Over two billion pounds of TRI chemicals were transferred to public sewage systems.

Transfers of chemicals to public sewage systems made up nine percent (2.2 billion pounds) of total TRI releases and transfers for 1987 (Figure 7-7). The individual chemical sodium sulfate represents 54 percent of the total transfers to public sewage systems equal to the proportion sodium sulfate is for all TRI releases and transfers and not as large as for discharges to surface water where it was 94 percent.

Geographical Distribution of Transfers to Public Sewage Systems

States

Facilities in the Mid-Atlantic, Great Lakes, and Southeastern states, California, and Texas transferred the largest amounts of TRI chemicals to public sewage systems.

Transfers of TRI chemicals to public sewage systems followed a different geographical pattern than for discharges to surface water (compare Maps 7-1 and 7-10). Facilities in the Mid-Atlantic, Great Lakes, and Southeastern regions, California and Texas transferred the largest amounts of TRI chemicals to sewage treatment systems (Map 7-10, Figure 7-8). Transfers in Illinois and California alone accounted for 23 percent of TRI chemical transfers to public sewage systems.

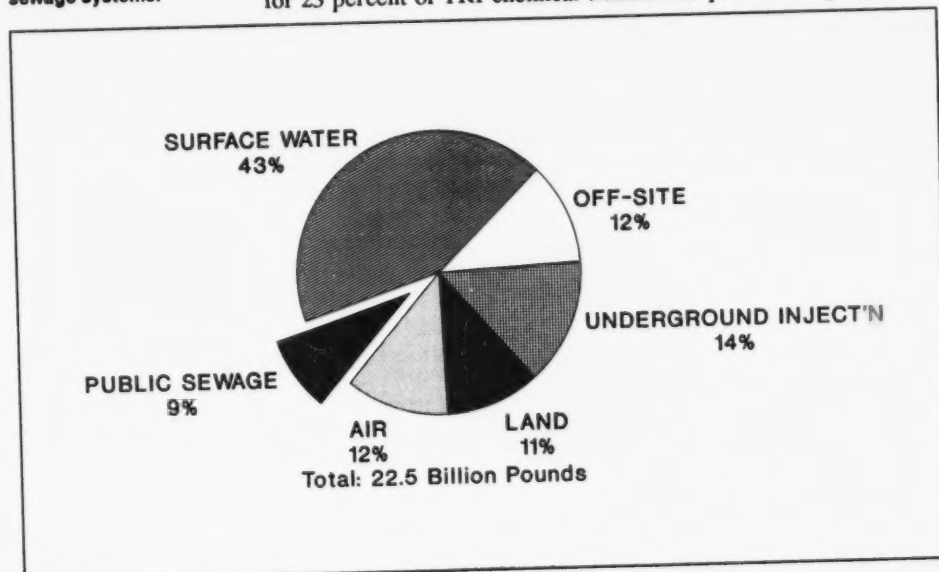


Figure 7-7.
Transfers to Public Sewage Systems as a Proportion of Total TRI Releases and Transfers, 1987.

(Chapter 12 includes an analysis of an Illinois public sewage system that received large transfers of TRI chemicals.)

Ten states each had over 60 million pounds of TRI chemicals transferred to public sewage systems (Figure 7-8). These ten states accounted for 67 percent (1.3 billion pounds) of all transfers to public sewage systems while the bottom ten states accounted for less than 0.1 percent (1.8 million pounds)(Table 7-8). Facilities in American Samoa and the Virgin Islands did not report any such transfers.

Public sewage transfers in ten states accounted for two thirds of the total.

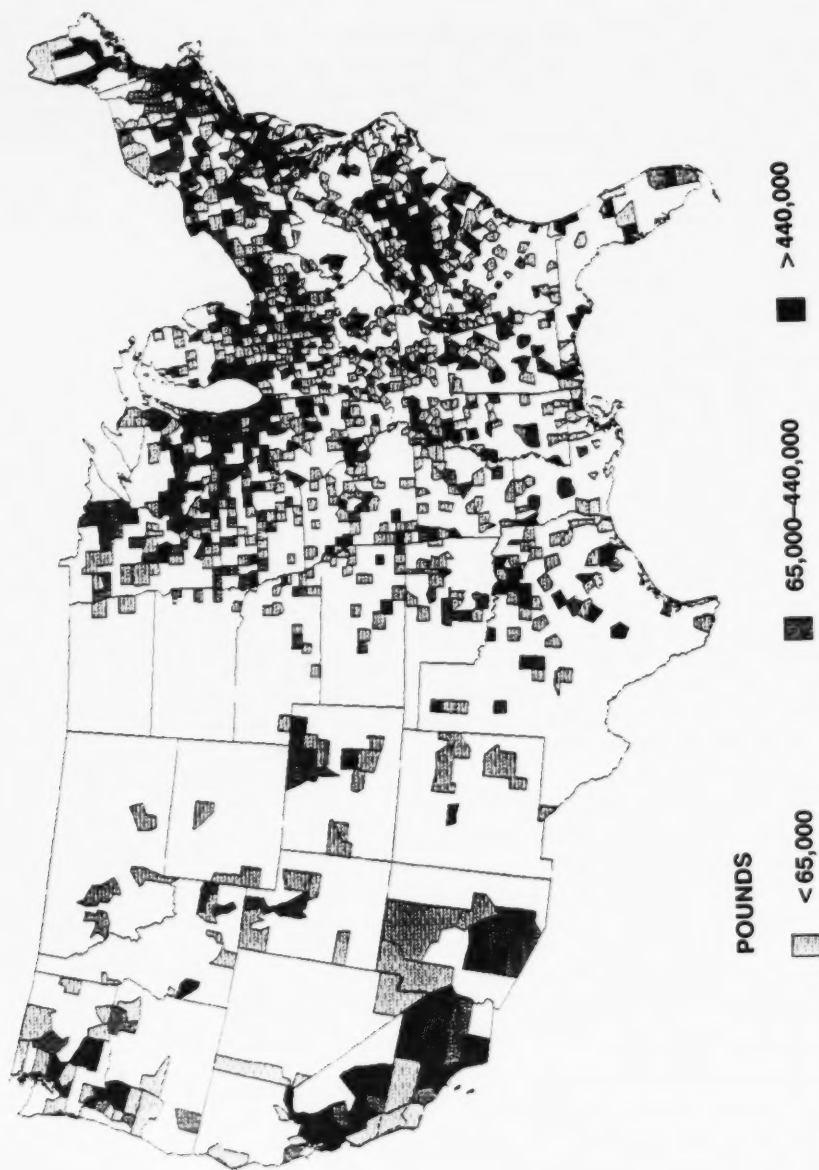
Transfers to public sewage systems comprised a smaller proportion of total releases of TRI chemicals in most states than did discharges to surface water. In only the following six jurisdictions did transfers to public sewage systems account for more than 30 percent of total TRI releases and transfers: Puerto Rico (54 percent); Minnesota (50 percent); Illinois (43 percent); New Jersey (40 percent); Missouri (38 percent); and Massachusetts (35 percent). Conversely, transfers of TRI chemicals to public sewage systems made up less than ten percent of the TRI releases and transfers totals in 32 states (Table 5-2).

Despite the fact that transfers to public sewage systems made up a much smaller fraction of the TRI total releases and transfers than did discharges to surface water, more than twice as many facilities reported transfers to public sewage systems (5,820 facilities and 2,663 facilities, respectively). The states with the largest number of facilities reporting transfers of TRI chemicals to public sewage systems were California (580), Ohio (419), Illinois (375), New Jersey (283), Michigan (271), and Pennsylvania (264) (Table 7-8). Minnesota had the largest percentage of facilities reporting transfers of TRI chemicals to public sewage systems (50 percent).

Counties

Over half of the transfers to public sewage systems took place in 25 counties across the nation (Table 7-9). The largest transfers took place in Los Angeles County, California, which accounted for 8 percent (164 million pounds) of the total. Facilities in each of eight other counties transferred over 50 million pounds of TRI chemicals to public sewage systems. Some counties accounted for a large portion of the transfers to public sewage systems in the state. For example, Hamilton County, Ohio had 81 million pounds of transfers of TRI chemicals to public sewage systems, which represented 62 percent of total transfers to public sewage systems in the state. Two Illinois two counties with large transfers to public sewage systems (Cook County and St. Clair County) together accounted for 79 percent of total transfers of TRI chemicals to public sewage systems in the state.

The TRI largest transfers to public sewage systems took place in Los Angeles County, California.



Map 7-10. Total Transfers of TRI Chemicals to Public Sewage Treatment Plants Reported Nationwide, by County, 1987

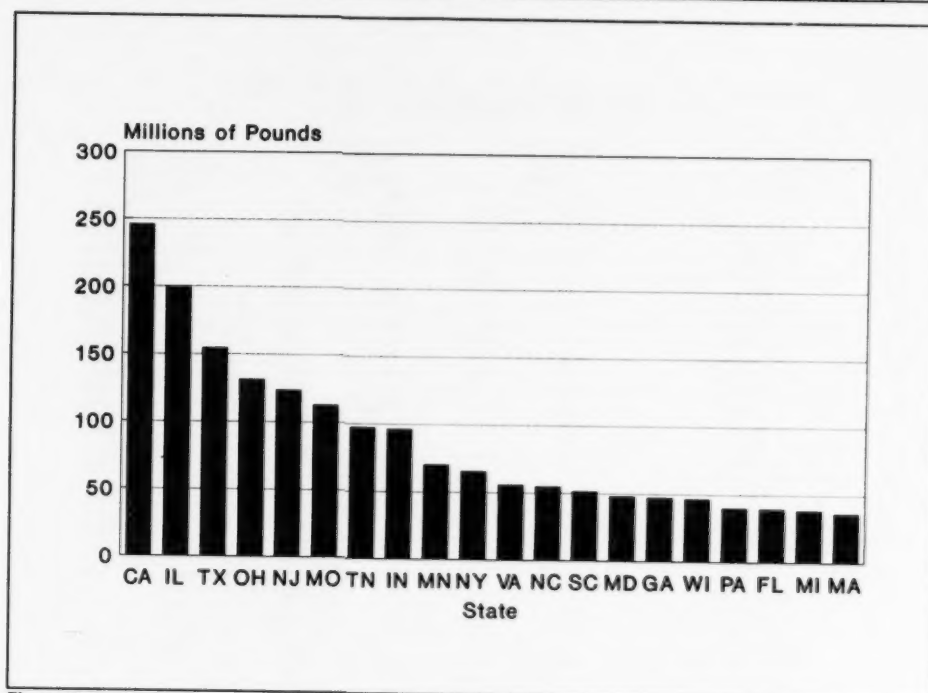


Figure 7-8.
The 20 States with the Largest Transfers of TRI Chemicals to Public Sewage Systems, 1987.

TABLE 7-8. TRI FACILITIES, FORMS AND AMOUNT OF TRANSFERS TO PUBLIC SEWAGE SYSTEMS BY STATE, 1987

Rank	STATE	FACILITIES WITH PUBLIC SEWAGE TRANSFERS		FORMS WITH PUBLIC SEWAGE TRANSFERS		TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS	
		Number	Percent	Number	Percent	Pounds	Percent
21	Alabama	70	1.20	169	1.09	32,713,211	1.69
51	Alaska	1	0.02	2	0.01	35	0.00
52	American Samoa	0	0.00	0	0.00	0	0.00
28	Arizona	50	0.86	138	0.89	9,236,876	0.48
33	Arkansas	66	1.13	122	0.79	4,325,937	0.22
1	California	580	9.97	1,459	9.43	246,101,588	12.72
36	Colorado	57	0.98	107	0.69	3,125,368	0.16
27	Connecticut	92	1.58	266	1.72	9,544,567	0.49
23	Delaware	20	0.34	86	0.56	16,375,820	0.85
18	Florida	86	1.48	182	1.18	39,468,550	2.04
15	Georgia	182	3.13	470	3.04	47,093,822	2.43
43	Hawaii	4	0.07	6	0.04	873,250	0.05
35	Idaho	18	0.31	43	0.28	3,250,118	0.17
2	Illinois	375	6.44	1,020	6.60	199,165,360	10.29
8	Indiana	222	3.81	556	3.59	95,896,156	4.95
26	Iowa	97	1.67	212	1.37	10,090,895	0.52
30	Kansas	55	0.95	130	0.84	6,647,139	0.34
25	Kentucky	105	1.80	314	2.03	13,649,364	0.71
41	Louisiana	35	0.60	77	0.50	1,334,641	0.07
32	Maine	25	0.43	85	0.42	5,071,706	0.26
14	Maryland	58	1.00	181	1.17	47,863,355	2.47
20	Massachusetts	202	3.47	500	3.23	36,142,507	1.87
19	Michigan	271	4.68	878	5.68	38,245,470	1.96
9	Minnesota	134	2.30	320	2.07	70,020,634	3.62
29	Mississippi	44	0.76	97	0.63	9,125,709	0.47
6	Missouri	169	2.90	479	3.10	112,489,968	5.81
49	Montana	5	0.09	13	0.08	28,106	0.00
42	Nebraska	44	0.78	81	0.52	1,213,294	0.06
48	Nevada	5	0.09	6	0.04	33,814	0.00
38	New Hampshire	38	0.65	70	0.45	2,802,094	0.14
5	New Jersey	283	4.88	927	5.99	123,413,118	6.38
44	New Mexico	8	0.14	20	0.13	736,719	0.04
10	New York	250	4.30	752	4.86	65,294,934	3.37
12	North Carolina	256	4.40	592	3.83	54,537,779	2.82
47	North Dakota	3	0.05	4	0.03	94,217	0.00
4	Ohio	419	7.20	1,256	8.12	131,193,018	6.78
40	Oklahoma	42	0.72	85	0.55	1,692,971	0.09
24	Oregon	52	0.89	109	0.70	13,900,170	0.72
17	Pennsylvania	264	4.54	657	4.25	39,815,049	2.06
22	Puerto Rico	46	0.79	143	0.92	23,060,360	1.19
37	Rhode Island	51	0.88	109	0.70	2,998,055	0.15
13	South Carolina	130	2.23	326	2.11	51,090,961	2.64
45	South Dakota	7	0.12	12	0.08	620,208	0.03
7	Tennessee	170	2.92	450	2.91	97,149,025	5.02
3	Texas	254	4.36	758	4.90	154,293,072	7.97
39	Utah	29	0.50	78	0.50	2,032,004	0.10
46	Vermont	15	0.26	33	0.21	298,037	0.02
53	Virgin Islands	0	0.00	0	0.00	0	0.00
11	Virginia	91	1.56	209	1.35	55,690,097	2.88
34	Washington	71	1.22	142	0.92	4,061,980	0.21
31	West Virginia	14	0.24	67	0.43	5,179,381	0.27
16	Wisconsin	253	4.35	686	4.44	46,313,952	2.39
50	Wyoming	2	0.03	2	0.01	17,600	0.00
TOTAL		5,820	100.00	15,466	100.00	1,935,517,370	100.00
PERCENT OF TOTAL		30.19		80.23		8.60	

TABLE 7-9. THE 25 COUNTIES WITH THE LARGEST TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS, 1987

COUNTY	STATE	TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS (pounds)	PERCENT OF PUBLIC SEWAGE TRANSFERS IN THE STATE
LOS ANGELES	CA	164,324,041	66.77
COOK	IL	95,000,228	47.70
HARRIS	TX	90,403,909	58.59
HAMILTON	OH	81,281,207	61.96
ST CLAIR	IL	62,842,576	31.55
SHELBY	TN	60,905,857	62.69
CARLTON	MN	53,437,550	76.32
MARION	IN	53,189,877	55.46
ST LOUIS	MO	50,281,464	44.70
CHESTERFIELD	VA	42,286,047	75.93
GULF	FL	29,682,013	75.20
ORANGE	CA	28,272,418	11.49
ST LOUIS CITY	MO	26,050,999	23.16
ALLEGANY	MD	24,159,000	50.47
MILWAUKEE	WI	24,034,324	51.89
PHILADELPHIA	PA	23,775,622	59.72
WARREN	NJ	23,747,670	19.24
GALVESTON	TX	23,053,365	14.94
MIDDLESEX	NJ	21,472,079	17.40
ESSEX	NJ	21,420,199	17.36
ANNE ARUNDEL	MD	20,010,649	41.81
LOUDON	TN	19,584,000	20.16
MUSKEGON	MI	19,449,975	50.86
BERGEN	NJ	18,420,605	14.93
BUCHANAN	MO	16,795,258	14.93
SUBTOTAL		1,093,880,872	
% OF GRAND TOTAL		56.52	
TOTAL FOR ALL OTHERS		841,636,498	
GRAND TOTAL		1,935,517,370	

Industries that Transferred TRI Chemicals to Public Sewage Systems

Industrial Distribution

The Chemical industry accounted for 41 percent of the total TRI transfers to public sewage systems.

The Chemical and Allied Products industry transferred the largest amount of TRI chemicals to public sewage systems, with 41 percent (784 million pounds) of all transfers to public sewage systems (Figure 7-9). (See Appendix C for a list of industries covered by TRI reporting requirements.)

Facilities in each of four additional industries, as well as the multiple industry category, transferred more than 100 million pounds of TRI chemicals to public sewage systems: Food and Kindred Products, with 11 percent (206 million pounds); Paper Products, with ten percent (185 million pounds); Primary Metals, with nine percent (180 million pounds); Textiles, with six percent (120 million pounds); and the multiple industry category with five percent (100 million pounds). Transfers of TRI chemicals to public sewage systems from these top industries, together with the Chemical industry, made up 76 percent

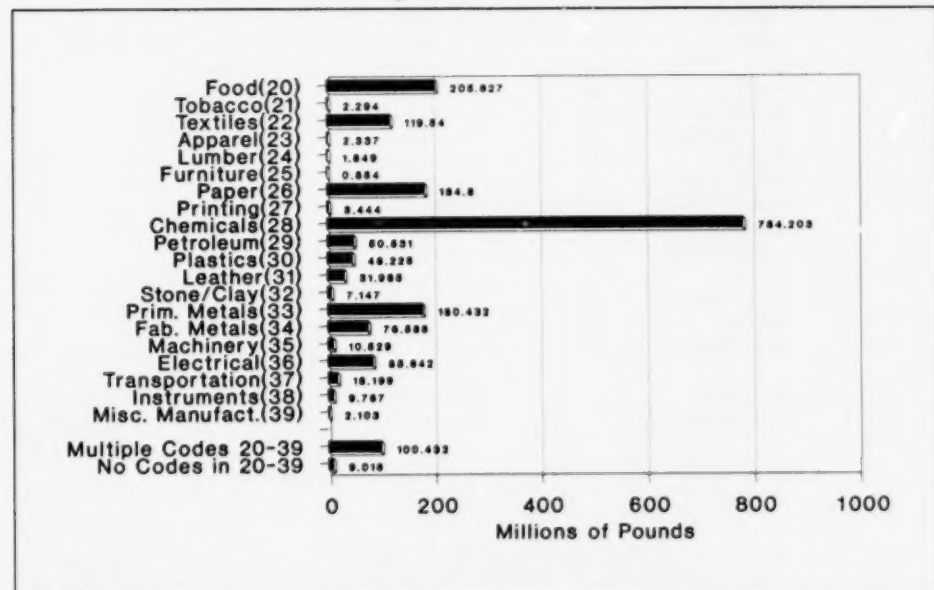


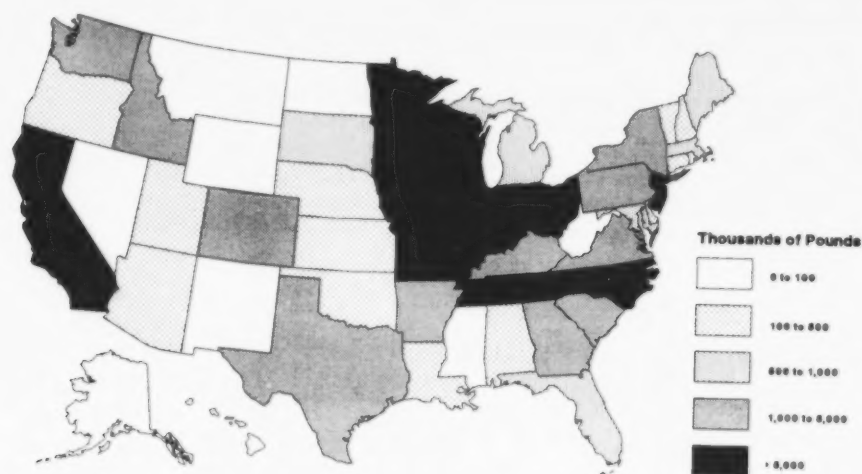
Figure 7-9. Transfers of TRI Chemicals to Public Sewage Systems by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

of the total. In comparison, the five industries with the lowest transfers together transferred nine million pounds of TRI chemicals to public sewage systems, less than 0.5 percent of the same total (Table 7-10).

Transfers for particular industries show different geographical distributions than the overall total. For example, transfers to public sewage systems from the Food industry are concentrated in the Great Lakes region and California (Map 7-11, next page). Food industry facilities in Indiana and Illinois transferred the largest amounts of TRI chemicals to public sewage systems.

TABLE 7-10. TRI FACILITIES, FORMS AND AMOUNT OF TRANSFERS TO PUBLIC SEWAGE SYSTEMS BY INDUSTRY, 1987

PUBLIC SEWAGE TRANSFER	SIC	INDUSTRY	TRI FACILITIES REPORTING PUBLIC SEWAGE TRANSFERS		TRI FORMS REPORTING PUBLIC SEWAGE TRANSFERS		TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS	
			Numbers	Percent	Numbers	Percent	Pounds	Percent
Rank	CODE							
2	20	Food Products	709	12.18	1,228	7.94	205,826,534	10.63
19	21	Tobacco Manufacturers	11	0.19	26	0.17	2,293,820	0.12
5	22	Textile Mill Products	231	3.97	489	3.16	119,540,333	6.18
18	23	Apparel	15	0.26	22	0.14	2,336,808	0.12
21	24	Lumber and Wood Products	59	1.01	154	1.00	1,545,461	0.08
22	25	Furniture and Fixtures	48	0.82	108	0.70	853,889	0.04
3	26	Paper Products	116	1.99	249	1.61	184,880,068	9.55
17	27	Printing, Publishing	88	1.51	142	0.92	3,444,032	0.18
1	28	Chemical Products	1,259	21.63	4,713	30.47	784,202,550	40.52
9	29	Petroleum Refining	66	1.13	279	1.80	50,530,645	2.61
10	30	Rubber and Plastic Products	152	2.61	250	1.62	48,224,867	2.49
11	31	Leather Products	39	0.67	109	0.70	31,984,904	1.65
16	32	Stone, Clay, Glass Products	105	1.80	159	1.29	7,146,933	0.37
4	33	Primary Metals	320	5.50	890	5.75	180,432,302	9.32
8	34	Fabricated Metals	844	14.50	2,009	12.99	76,585,656	3.96
13	35	Machinery, except Electrical	195	3.35	439	2.84	10,528,549	0.54
7	36	Electric and Electronic Equip.	563	9.67	1,468	9.49	85,642,196	4.42
12	37	Transportation Equipment	299	5.14	1,041	6.73	18,199,214	0.94
14	38	Measuring, Photographic Goo	104	1.79	244	1.58	9,766,977	0.50
20	39	Misc. Manufacturing	52	0.89	105	0.68	2,103,483	0.11
6	Multiple SIC codes in 20 - 39		474	8.14	1,111	7.18	100,432,157	5.19
15	No SIC codes in 20 - 39		71	1.22	191	1.23	9,015,992	0.47
TOTAL			5,820	100.00	15,466	100.00	1,935,517,370	100.00
PERCENT OF ALL REPORTING			30.19		20.86		8.60	



Map 7-11.
Transfers to Public Sewage Systems by the Food and Kindred Products Industry, 1987.

Facilities engaged in "manufacture only" reported 42 percent of the total TRI transfers to public sewage systems.

Industrial Activities and Use

Facilities that identified *manufacture only* in the activities and uses section of the TRI form submitted just seven percent of the chemical TRI forms reporting transfers to public sewage systems (1,064 forms), but were responsible for the largest amount of transfers—810 million pounds, or 42 percent of the total (Figure 7-10). Facilities reporting *process only* uses submitted 31 percent of the TRI forms for transfers of TRI chemicals to public sewage systems (4,746 forms), but accounted for only five percent of such transfers (96 million pounds). Facilities that indicated *other uses* for TRI chemicals filed 42 percent of the TRI forms (6,449 forms), reporting transfers of TRI chemicals to public sewage systems, which accounted for 19 percent of such transfers (364 million pounds). Facilities listing *combined uses* accounted for 34 percent (657 million pounds) of transfers to public sewage systems and 20 percent of the TRI forms reporting such transfers (3,096 forms).

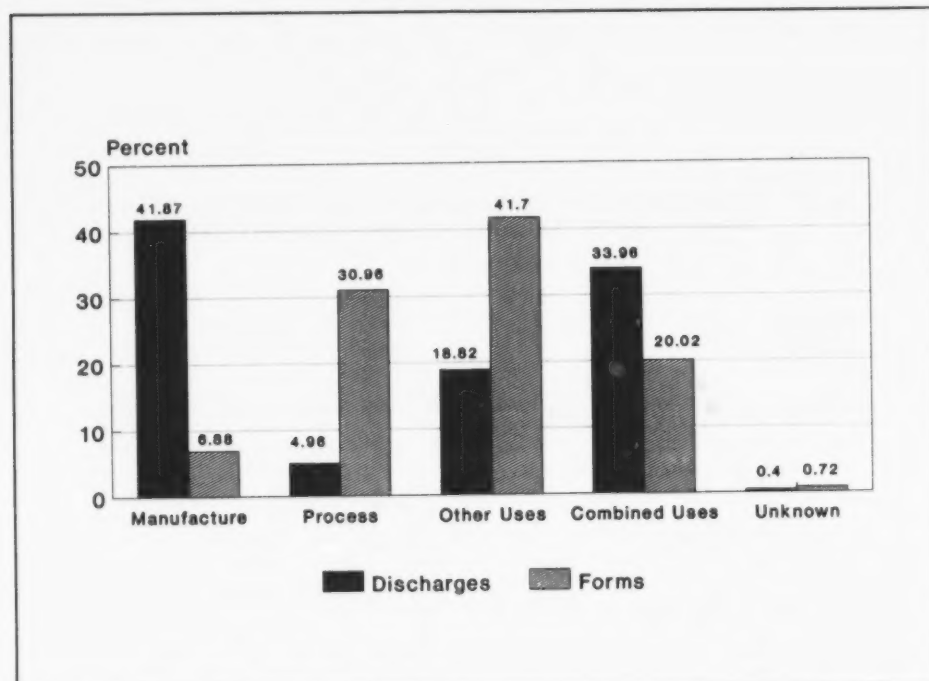


Figure 7-10.
Distribution of Transfers of TRI Chemicals to Public Sewage Systems by Activity and Use, 1987.

Chemicals Transferred to Public Sewage Systems

The 25 TRI chemicals with the largest transfers to public sewage systems accounted for 98 percent (1.9 billion pounds) of such transfers (Table 7-11). Sodium sulfate represented 54 percent of transfers to public sewage systems (see Box 7-A). Five other chemicals accounted for 35 percent of transfers of TRI chemicals to public sewage systems (679 million pounds). These six chemicals accounted for 89 percent of all transfers to public sewage systems.

Eight of the top ten chemicals for transfers to public sewage systems were also among the top ten for total TRI releases and transfers. However, several chemicals that ranked in the top 25 for transfers to public sewage systems ranked much lower for total TRI releases and transfers (Table 7-11). For example, aniline ranked 22nd for public sewage discharges, but 76th for total TRI releases and transfers.

Twenty-five TRI chemicals accounted for 96 percent of the total TRI transfers to public sewage systems; sodium sulfate alone accounted for 54 percent.

TABLE 7-11. NUMBER OF TRI FORMS AND AMOUNT OF TRANSFERS FOR THE 25 CHEMICALS WITH THE LARGEST TRANSFERS TO PUBLIC SEWAGE SYSTEMS, 1987

TOTAL TRI RELEASE/ TRANSFER	Rank	CHEMICAL NAME	FORMS WITH PUBLIC SEWAGE TRANSFERS		TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS	
			Number	Percent	Pounds	Percent
	1	SODIUM SULFATE (SOLUTION)	678	4.38	1,052,044,588	54.35
	6	SODIUM HYDROXIDE (SOLUTION)	2,229	14.41	239,349,220	12.37
	3	AMMONIUM SULFATE (SOLUTION)	129	0.83	189,392,111	9.79
	5	SULFURIC ACID	929	6.01	100,123,426	5.17
	8	METHANOL	404	2.61	92,511,680	4.78
	4	HYDROCHLORIC ACID	575	3.72	57,602,155	2.98
	7	AMMONIA	407	2.63	36,650,299	1.89
	22	NITRIC ACID	394	2.55	30,900,534	1.60
	10	PHOSPHORIC ACID	527	3.41	15,425,906	0.80
	30	ETHYLENE GLYCOL	367	2.37	14,771,295	0.76
	11	ACETONE	288	1.86	14,057,015	0.73
	20	AMMONIUM NITRATE (SOLUTION)	20	0.13	9,804,639	0.51
	41	CHROMIUM	258	1.67	8,719,797	0.45
	19	CHLORINE	221	1.43	6,552,692	0.34
	40	PHENOL	164	1.06	5,591,016	0.29
	28	GLYCOL ETHERS	307	1.98	5,161,890	0.27
	12	XYLENE (MIXED ISOMERS)	338	2.19	4,102,755	0.21
	9	TOLUENE	431	2.79	3,418,364	0.18
	48	FORMALDEHYDE	211	1.36	3,214,839	0.17
	2	ALUMINUM OXIDE	169	1.09	2,976,516	0.15
	31	N-BUTYL ALCOHOL	118	0.76	2,599,823	0.13
	76	ANILINE	20	0.13	1,829,020	0.09
	23	ZINC (FUME OR DUST)	168	1.09	1,777,237	0.09
	16	ZINC COMPOUNDS	437	2.83	1,734,423	0.09
	17	DICHLOROMETHANE	264	1.71	1,627,208	0.08
		SUBTOTAL	10,053	65.00	1,901,938,448	98.27
		TOTAL FOR ALL OTHERS	5,413	35.00	33,578,922	1.73
		GRAND TOTAL	15,466	100.00	1,935,517,370	100.00

TABLE 7-12. TRI CHEMICALS WITH NO REPORTED TRANSFERS TO PUBLIC SEWAGE SYSTEMS, 1987

(Of the 272 chemicals for which some releases were reported)

1	1,1,2,2-TETRACHLOROETHANE
2	1,1-DIMETHYL HYDRAZINE
3	1,2-DICHLOROETHYLENE
4	1,3-DICHLOROPROPYLENE
5	2,4,6-TRICHLOROPHENOL
6	2,4-DIAMINOTOLUENE
7	2,4-DICHLOROPHENOL
8	2,6-XYLIDINE
9	2-CHLOROACETOPHENONE
10	4,4'-METHYLENEBIS(2-CHLORO ANILINE)
11	4,4'-METHYLENEBIS(N,N-DIMETHYL)
12	4-AMINOAZOBENZENE
13	4-AMINOBIPHENYL
14	ACETAMIDE
15	ALPHA-NAPHTHYLAMINE
16	BENZAL CHLORIDE
17	BENZOIC TRICHLORIDE
18	BIS(CHLOROMETHYL) ETHER
19	BROMOMETHANE
20	CALCIUM CYANAMIDE
21	CARBONYL SULFIDE
22	CHLORAMMBEN
23	CHLOROBENZILATE
24	CHLOROETHANE
25	CHLOROMETHYL METHYL ETHER
26	C.I. ACID BLUE 9, DIAMMONIUM SALT
27	C.I. SOLVENT YELLOW 14
28	C.I. SOLVENT YELLOW 3
29	DICOFOL
30	ETHYL CHLOROFORMATE
31	HEXACHLOROETHANE
32	HYDRAZINE SULFATE
33	METHOXYCHLOR
34	METHYL HYDRAZINE
35	METHYL IODIDE
36	METHYL ISOCYANATE
37	MICHLER'S KETONE
38	NITROGEN MUSTARD
39	NITROGLYCERIN
40	N-NITROSODIPHENYLAMINE
41	PARATHION
42	PERACETIC ACID
43	PHOSGENE
44	PICRIC ACID
45	POLY BROMINATED BIPHENYLS
46	PROPANE SULFONE
47	PROPIONALDEHYDE
48	PROPOXUR
49	P-ANISIDINE
50	P-NITROSODIPHENYLAMINE
51	QUINONE
52	QUINTOZENE
53	STYRENE OXIDE
54	TETRACHLORVINPHOS
55	THALLIUM
56	THALLIUM COMPOUNDS
57	THORIUM DIOXIDE
58	TITANIUM TETRACHLORIDE
59	VANADIUM (FUME OR DUST)
60	VINYL BROMIDE

Of the 272 TRI chemicals for which TRI releases were reported, 212 (78 percent) were transferred in some amount to public sewage systems while 60 (22 percent) were not transferred to public sewage systems (Table 7-12).

Eighty-eight percent of TRI transfers to public sewage systems were acids/bases/salts.

Chemical Classes

Transfers of TRI chemicals in the acids/bases/salts class accounted for 88 percent of total transfers of TRI chemicals to public sewage systems (1.7 billion pounds), and transfers of organics comprised another nine percent (166 million pounds) (Table 7-13, Figure 7-11). The other chemical classes each accounted for less than three percent of such transfers.

Selected Chemicals

Transfers of individual TRI chemicals to public sewage systems show distinctive geographical distributions that differ from the discharge patterns nationwide. Maps 7-12 through 7-18 illustrate the distribution of transfers to public sewage systems of toluene, trichloroethylene, sodium sulfate, tetrachloroethylene, chromium, phenol, and metals and metal compounds.

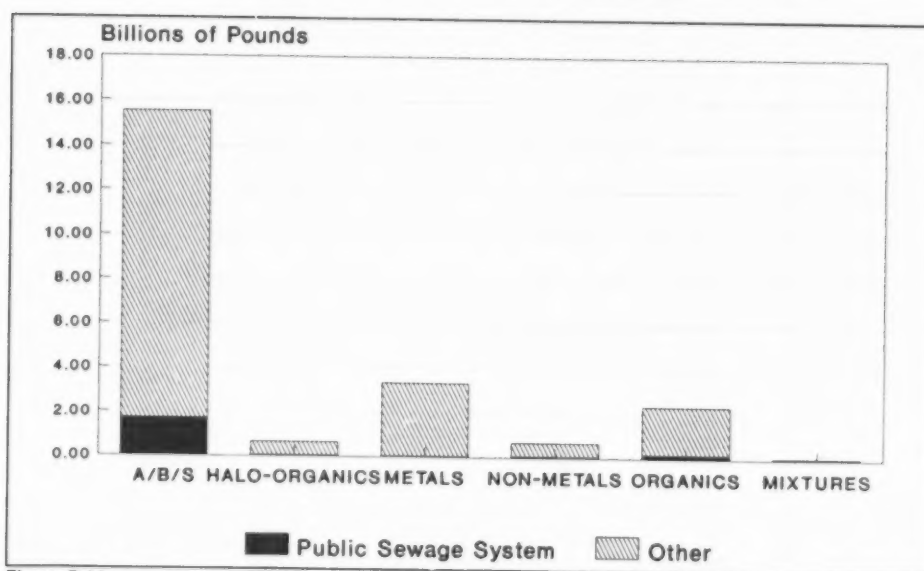


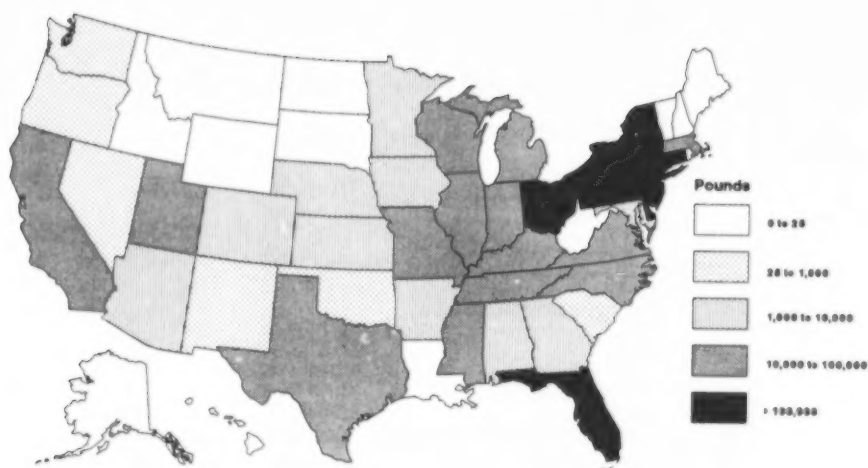
Figure 7-11.
Transfers to Public Sewage Systems as a Proportion of Total TRI Releases and Transfers, by Chemical Class, 1987. A/B/S = Acids/Bases/Salts.

TABLE 7-13. TRI TRANSFERS TO PUBLIC SEWAGE SYSTEMS
BY CHEMICAL CLASS, 1987

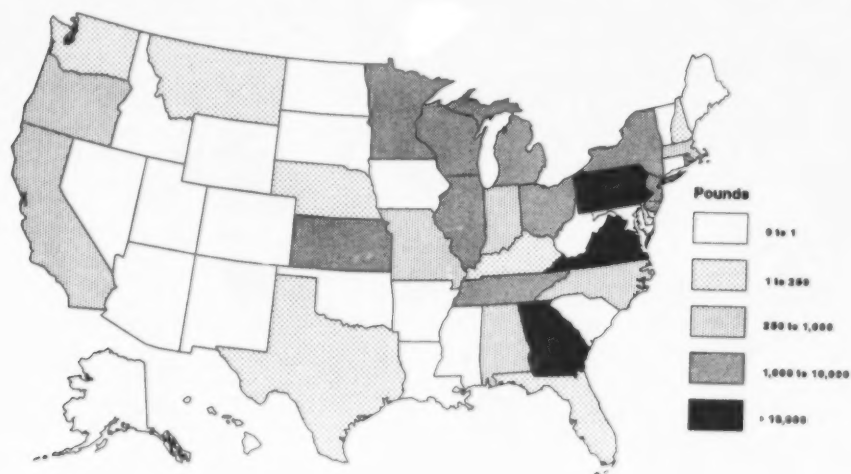
TOTAL TRI RELEASE/ TRANSFER		TRANSFERS TO PUBLIC SEWAGE SYSTEMS Pounds	PERCENT OF TOTAL PUBLIC SEWAGE TRANSFERS
Rank	CHEMICAL NAME		
Acids/Bases/Salts			
1	SODIUM SULFATE (SOLUTION)	1,052,044,568	54.35
3	AMMONIUM SULFATE (SOLUTION)	189,392,111	9.79
4	HYDROCHLORIC ACID	57,602,155	2.98
5	SULFURIC ACID	100,123,426	5.17
6	SODIUM HYDROXIDE (SOLUTION)	239,349,220	12.37
10	PHOSPHORIC ACID	15,425,906	0.80
	Subtotal	1,653,937,406	85.45
	TOTAL FOR ALL OTHERS IN CLASS	42,953,440	2.22
	TOTAL FOR CLASS	1,696,890,846	87.67
Halo-organics			
14	T, T, T-TRICHLOROETHANE	418,380	0.02
17	DICHLOROMETHANE	1,827,206	0.08
25	FREON 113	105,101	0.01
26	TRICHLOROETHYLENE	120,299	0.01
35	TETRACHLOROETHYLENE	415,773	0.02
	Subtotal	2,686,761	0.14
	TOTAL FOR ALL OTHERS IN CLASS	4,152,181	0.21
	TOTAL FOR CLASS	6,838,942	0.35
Metals and Metal Compounds			
2	ALUMINUM OXIDE	2,976,516	0.15
15	COPPER	537,980	0.03
16	ZINC COMPOUNDS	1,734,423	0.09
21	MANGANESE COMPOUNDS	599,093	0.03
	ZINC (FUME OR DUST)	1,777,237	0.09
	Subtotal	7,625,239	0.39
	TOTAL FOR ALL OTHERS IN CLASS	12,866,566	0.66
	TOTAL FOR CLASS	20,321,805	1.05
Non-metallic Inorganics			
7	AMMONIA	36,650,299	1.89
19	CHLORINE	6,552,692	0.34
49	ARSENIC COMPOUNDS	5,271	0.00
50	ASBESTOS (FRIABLE)	340,778	0.02
57	CHLORINE DIOXIDE	14,282	0.00
	Subtotal	43,563,322	2.25
	TOTAL FOR ALL OTHERS IN CLASS	101,438	0.01
	TOTAL FOR CLASS	43,664,760	2.26
Organics (non-halogenated)			
8	METHANOL	92,511,680	4.78
9	TOLUENE	3,418,364	0.18
11	ACETONE	14,057,015	0.73
12	XYLENE (MIXED ISOMERS)	4,102,755	0.21
13	METHYL ETHYL KETONE	812,678	0.03
	Subtotal	114,702,492	5.93
	TOTAL FOR ALL OTHERS IN CLASS	51,549,702	2.66
	TOTAL FOR CLASS	166,252,194	8.59
34	TOTAL FOR MIXTURES	1,135,285	0.06
100	TOTAL FOR TRADE SECRETS	413,538	0.02
GRAND TOTAL		1,935,517,370	100.00

Transfers of toluene and trichloroethylene to public sewage systems occurred primarily in the Great Lake states, which is a similar distribution to overall TRI releases and transfers for these chemicals (see Maps 5-3 and 5-4).

Sodium sulfate was reported transferred in the largest amounts to public sewage systems in California, Texas and the Eastern United States. Tetrachloroethylene was reported transferred in the largest amounts in a few, more widely scattered states, such as several states in the West, a few in the Midwest, a few in the mid-Atlantic region, and a few in the Southeast. Chromium, like sodium sulfate, was transferred in a broad range of states on the West Coast, and in the mid-West, Great Lakes, and Mid-Atlantic states as well as Texas and Louisiana. Transfers to public sewage systems of phenol were almost exclusively reported by states in the Eastern half of the United States, except for California and Texas, which also reported large transfers. Transfers of metals and metal compounds to public sewage systems were more widely distributed with only facilities in a few states not reporting any.



Map 7-12.
Transfers of Toluene to Public Sewage Systems Reported to TRI, 1987.

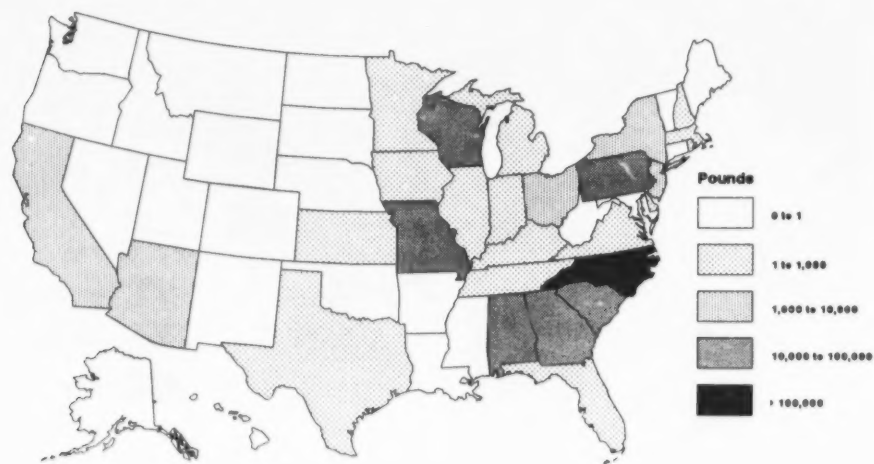


Map 7-13.
Transfers of Trichloroethylene to Public Sewage Systems, 1987.

Discharges of Sodium Sulfate to Public Sewage Systems Reported to TRI, 1987



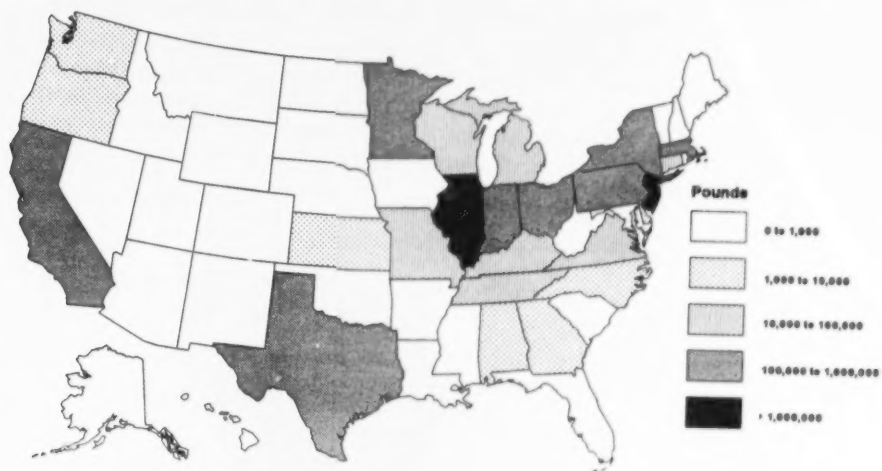
Map 7-14.
Transfers of Sodium Sulfate to Public Sewage Systems Reported to TRI, 1987.



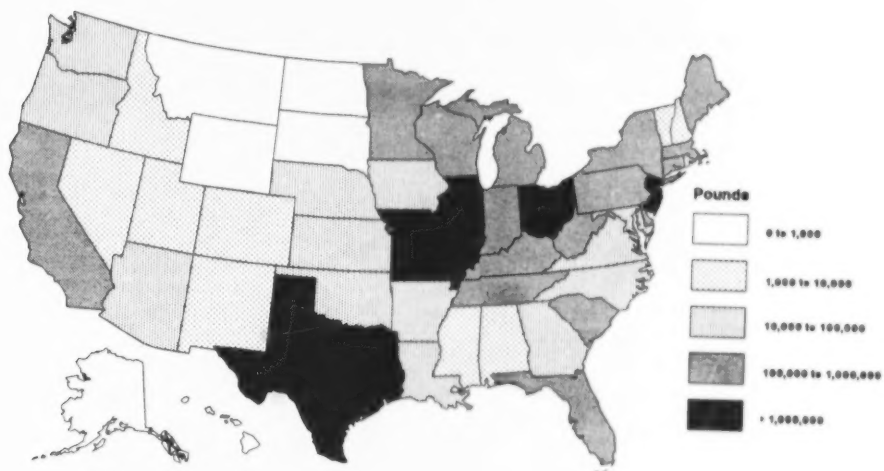
Map 7-15.
Transfers of Tetrachloroethylene to Public Sewage Systems Reported to TRI, 1987.



Map 7-16.
Transfers of Chromium to Public Sewage Systems Reported to TRI, 1987.



Map 7-17.
Transfers of Phenol to Public Sewage Systems Reported to TRI, 1987.



Map 7-18.
Transfers of Metals and Metal Compounds to Public Sewage Systems Reported to TRI, 1987.

Basis of Estimate for Transfers to Public Sewage Systems

Facilities measured approximately one-sixth (17 percent) of the total amount of transfers to public sewage treatment plants (Figure 7-12). One-fifth (21 percent) were arrived at by calculation, four percent by emission factors, and 29 percent were estimated by other methods. The methods used for 28 percent of the discharges were unknown.

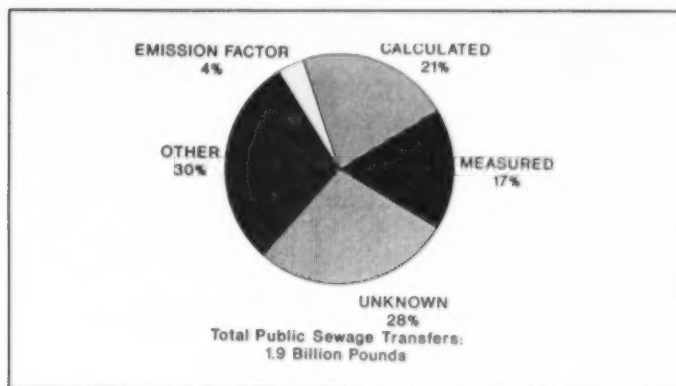


Figure 7-12.
Basis of Estimate for Transfers to Public Sewage Systems, 1987.

The Impact of Sodium Sulfate on TRI Surface Water Discharges and Transfers to Public Sewage Systems

Approximately 84 percent (10.1 billion pounds) of the 12.1 billion pounds of sodium sulfate reported released to the environment was released to water. Sodium sulfate releases accounted for 94 percent of direct releases to water and 54 percent of releases to public sewage systems.

Without sodium sulfate, a much different picture emerges for releases to water. Without sodium sulfate, direct releases to water would total 555 million pounds instead of 9.6 billion pounds and would account for only 5 percent instead of 43 percent of all chemical releases reported under TRI for 1987. Releases to public sewage systems would decrease from 1.9 billion pounds to 884 million pounds but would account for approximately the same percentage (8.5 percent instead of 8.6 percent) of total releases reported under TRI. Thus, releases to public sewage systems would then account for a larger portion of total releases than direct releases.

The chemical with the next highest direct releases to water is phosphoric acid (129 million pounds) which would account for 23 percent instead of one percent of direct releases to water. The chemical with the second highest releases to public sewage systems is sodium hydroxide (239 million pounds), which would account for 27 percent instead of 12 percent of releases to public sewage systems.

Box 7-A.



Chapter 8. On-site Land Releases and Underground Injection

Introduction

Facilities dispose of solid and liquid chemical wastes on land by either depositing and burying the wastes near the surface, referred to in this report as **land releases**, or by **underground injection** – injecting liquid wastes into underground wells. These two land disposal methods can take place either at the waste generating facility's own location, known as **on-site** disposal, or at another location, known as **off-site** disposal. Unless otherwise indicated, all references to land releases and underground injections in this chapter are limited to on-site disposal only. (See Chapter 9 for more information on land releases and underground injection at off-site locations.)

Facilities released 2.5 billion pounds of TRI chemicals to land on-site and injected 3.2 billion pounds into underground injection wells.

In 1987, facilities released 2.5 billion pounds of Toxics Release Inventory (TRI) chemicals to land on-site and injected 3.2 billion pounds into on-site underground wells, for a total of nearly six billion pounds, or 25 percent of all TRI releases and transfers (Figure 8-1). In addition,

- 683 million pounds of TRI chemicals were released to land at **off-site facilities** or locations. Combining on-site with the off-site land releases, a total of 3.1 billion pounds of TRI chemicals were released to land; 78 percent of this total was disposed of on-site.
- 95 million pounds of TRI chemicals were transferred to **off-site facilities** that disposed of them in underground wells. Thus, out of the total of 3.3 billion pounds of TRI chemicals disposed of through both on-site and off-site underground injection, 97 percent was injected on-site.

The off-site land and underground injection releases are discussed in Chapter 9 and are not included in this chapter.

Despite the significant amount of releases, however, relatively few facilities reported disposing of TRI chemicals on land or in underground wells. Eleven percent of all TRI facilities (1,886 facilities) reported on-site releases to land in eight percent (5,261) of all TRI forms submitted – and half of those forms were for amounts less than 500 pounds. Only 185 facilities (one percent of all TRI facilities) reported underground injection, in one percent (670) of all forms.

Only 11 percent of TRI facilities reported on-site land releases, and only 1 percent reported underground injection.

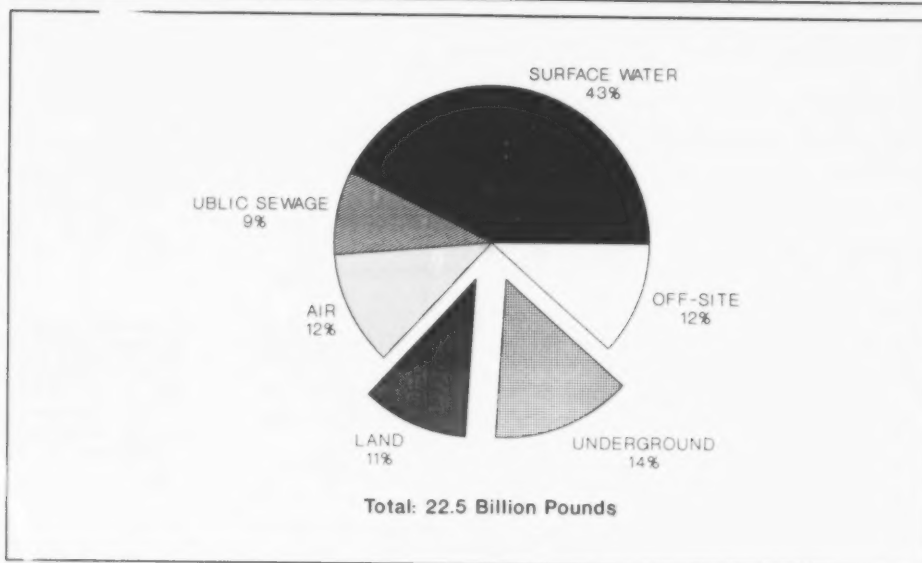


Figure 8-1.
TRI Land Releases and Underground Injection Compared to Total Releases and Transfers, 1987.

This chapter examines where facilities released TRI chemicals to land and by underground injection, which industries did so, and the specific chemicals that were disposed of in the largest amounts. Land disposal and underground injection are discussed in separate sections of this chapter.

ON-SITE RELEASES TO LAND

On-site releases to land reported to TRI were 2.4 billion pounds, 11 percent of the total TRI releases and transfers (Figure 8-1). The TRI forms specified the type of land release according to four categories: landfills, land treatment, surface impoundments and other. The largest portion of reported TRI land releases was to surface impoundments (1.4 billion pounds, 56 percent) with the second largest being to landfills (419 million pounds), 17 percent (Figure 8-2).

Geographical Distribution of Releases to Land

States

Facilities in states along the Gulf Coast and Great Lakes and in several Western states released the largest amounts of TRI chemicals to land (Map 8-1). Texas facilities released larger amounts of TRI chemicals to land than any other state, with releases totaling 835 million pounds, or one-third of the total land releases (Figure 8-3, Table 8-1). Facilities in each of five additional states – Indiana, Florida, Utah, Louisiana, and Arkansas – also released over 100 million pounds of TRI chemicals to land, and the next four states each released over 50 million

Facilities in Texas alone released one third of all TRI on-site land releases.

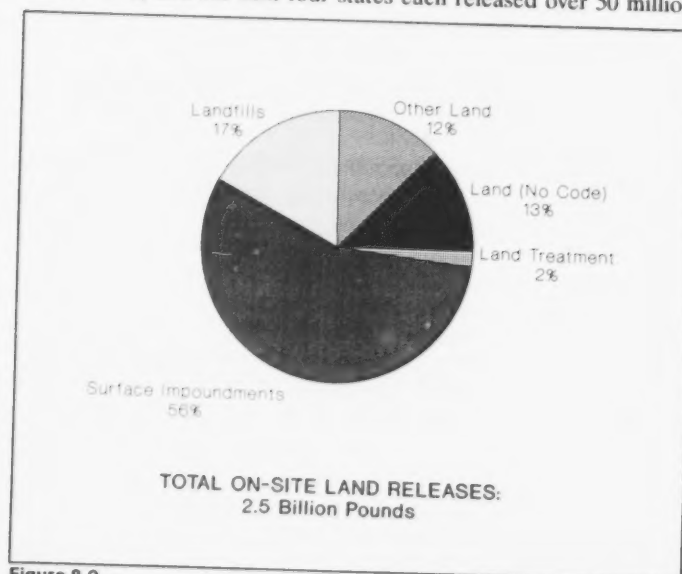


Figure 8-2.
Types of TRI Land Releases, 1987. Total on-site land releases: 2.5 billion pounds.

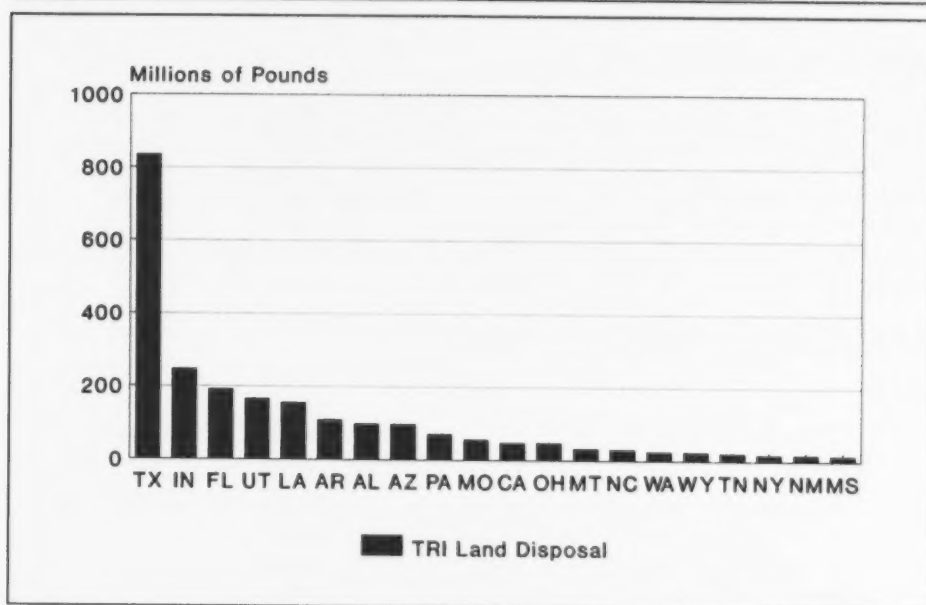


Figure 8-3.

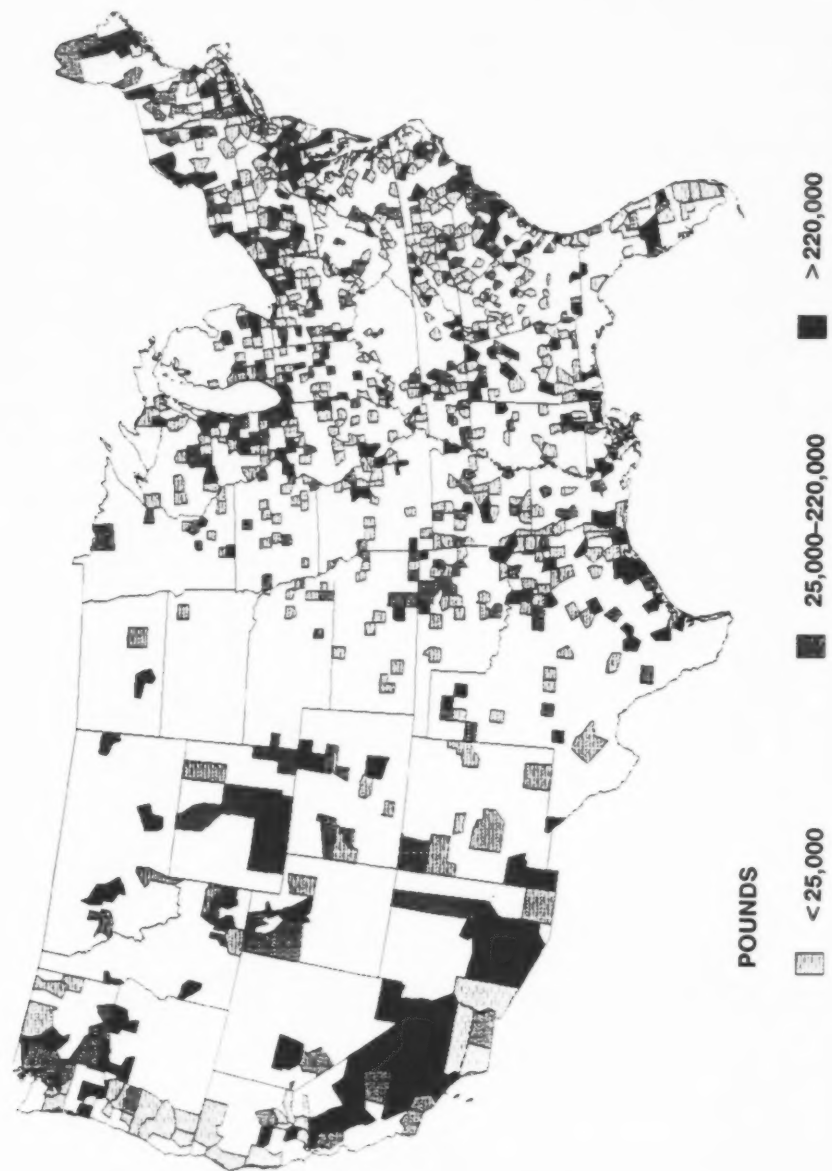
The 20 States with the Largest On-site Land Releases of TRI Chemicals, 1987.

pounds. Land releases from the top ten states combined comprised 83 percent (1.9 billion pounds) of the total on-site land releases.

In several states, a single large release (release of one TRI chemical by one facility over the course of the year) dominated the state's land releases. For example, a single facility in Arkansas reported the disposal of 103 million pounds of aluminum oxide in a surface impoundment, the fifth largest individual land release in the country, which accounted for fully 95 percent of the land releases in Arkansas¹. In another example, two facilities in Texas owned by the same parent company disposed of 350 million pounds and 321 million pounds of aluminum oxide to surface impoundments.² These releases were the two largest reported land releases in any state. In Florida, two in-

¹ Aluminum Company of North America in Bauxite, Arkansas.

² Aluminum Company of America, in Rockdale and Point Comfort, Texas.



Map 8-1. Total On-Site Releases of TRI Chemicals on Land Reported Nationwide, by County, 1987.

Chapter 8

TABLE 8-1. TRI FACILITIES, FORMS AND AMOUNT OF TOTAL ON-SITE LAND RELEASES BY STATE, 1987

TOTAL TRI ON-SITE LAND RELEASE		TOTAL TRI FACILITIES WITH ON-SITE LAND RELEASES		TOTAL TRI FORMS WITH ON-SITE LAND RELEASES		TOTAL TRI ON-SITE LAND RELEASES	
Rank	STATE	Number	Percent	Number	Percent	Pounds	Percent
7	Alabama	57	3.02	164	3.12	98,091,692	4.00
51	Alaska	2	0.11	14	0.27	14,930	0.00
53	American Samoa	0	0.00	0	0.00	0	0.00
8	Arizona	15	0.80	49	0.93	97,102,866	3.96
6	Arkansas	40	2.12	104	1.98	108,534,294	4.43
11	California	122	6.47	333	6.33	47,693,392	1.95
24	Colorado	20	1.06	54	1.03	12,547,494	0.51
39	Connecticut	25	1.33	54	1.03	1,848,676	0.08
36	Delaware	9	0.48	29	0.55	2,565,876	0.10
3	Florida	48	2.55	86	1.63	190,827,201	7.78
22	Georgia	67	3.55	149	2.83	14,969,473	0.61
46	Hawaii	13	0.69	38	0.72	237,342	0.01
21	Idaho	11	0.58	31	0.59	14,988,307	0.61
26	Illinois	94	4.98	228	4.33	11,209,153	0.46
2	Indiana	68	3.61	221	4.20	246,523,580	10.05
43	Iowa	25	1.33	46	0.87	768,722	0.03
42	Kansas	22	1.17	67	1.27	1,058,669	0.04
33	Kentucky	26	1.38	85	1.62	4,028,637	0.16
5	Louisiana	52	2.76	226	4.30	154,894,837	6.32
38	Maine	8	0.42	19	0.36	2,037,139	0.08
32	Maryland	13	0.69	55	1.05	4,318,725	0.18
35	Massachusetts	32	1.70	44	0.84	3,575,212	0.15
34	Michigan	59	3.13	135	2.57	3,979,327	0.16
40	Minnesota	17	0.90	67	1.27	1,722,105	0.07
20	Mississippi	28	1.48	80	1.52	15,252,731	0.62
10	Missouri	46	2.44	111	2.11	56,439,000	2.30
13	Montana	9	0.48	35	0.67	32,223,598	1.31
45	Nebraska	16	0.85	37	0.70	349,910	0.01
27	Nevada	7	0.37	12	0.23	10,817,492	0.44
44	New Hampshire	6	0.32	13	0.25	666,529	0.03
31	New Jersey	49	2.60	156	2.97	5,312,503	0.22
19	New Mexico	9	0.48	17	0.32	17,307,456	0.71
18	New York	54	2.86	137	2.60	17,598,716	0.72
14	North Carolina	73	3.87	172	3.27	30,157,949	1.23
41	North Dakota	3	0.16	3	0.06	1,100,500	0.04
12	Ohio	125	6.63	396	7.53	47,664,590	1.94
37	Oklahoma	27	1.43	98	1.86	2,482,881	0.10
23	Oregon	24	1.27	52	0.99	13,998,763	0.57
9	Pennsylvania	94	4.98	252	4.79	70,957,429	2.89
47	Puerto Rico	9	0.48	31	0.59	184,150	0.01
50	Rhode Island	4	0.21	6	0.11	69,009	0.00
28	South Carolina	55	2.92	134	2.55	8,994,959	0.37
52	South Dakota	1	0.05	2	0.04	9	0.00
17	Tennessee	55	2.92	128	2.43	20,550,544	0.84
1	Texas	136	7.21	566	10.76	835,087,965	34.06
4	Utah	23	1.22	68	1.29	165,467,430	6.75
48	Vermont	5	0.27	8	0.15	168,696	0.01
49	Virgin Islands	1	0.05	19	0.36	87,505	0.00
30	Virginia	45	2.39	99	1.88	6,949,712	0.28
15	Washington	45	2.39	124	2.36	25,105,014	1.02
25	West Virginia	24	1.27	69	1.31	11,638,215	0.47
29	Wisconsin	55	2.92	112	2.13	7,535,521	0.31
16	Wyoming	13	0.69	26	0.49	24,183,539	0.99
TOTAL		1,886	100.00	5,261	100.00	2,451,889,964	100.00
PERCENT OF ALL REPORTING		9.78		7.09		10.89	

dividual releases of phosphoric acid accounted for 82 percent of the state's on-site land releases.³

Large individual releases of TRI chemicals also dominated total land releases in Utah and Louisiana. One Utah facility in Toole County⁴ released 130 million pounds of copper to surface impoundments and other types of disposal, the fourth largest individual land release in the country and an amount that comprised 79 percent of Utah's land releases. A single Louisiana facility⁵ released 149 million pounds of aluminum oxide to land, the third largest individual land release in the country and comprising 96 percent of the land releases of TRI chemicals in Louisiana.

Land disposal in several states was dominated by large releases of a single chemical by an individual facility.

Large individual releases in Indiana, Arizona, Alabama, Pennsylvania, and Missouri were also among the top-ranked individual land releases, and accounted for significant portions of the land releases in each state, ranging from 52 percent in Arizona (50 out of 97 million pounds) to 26 percent in Pennsylvania (19 out of 71 million pounds). On the other end of the spectrum, facilities in nine jurisdictions reported releases under 500,000 pounds each (Table 8-1).

Land Releases as Proportion of State TRI Releases and Transfers

On the whole, land releases accounted for only 11 percent of the total amount of TRI chemicals released or transferred in the nation. In several Western states, however, land releases represented a significant proportion—more than half—of total TRI chemical releases and transfers (see Chapter 5, Table 5-2). Nevada facilities reported disposing of 92 percent of their total TRI chemical wastes by on-site land releases, followed by Montana with 84 percent, Arizona with 77 percent, New Mexico with 77 percent, and Utah with 66 percent.

In several Western states, land disposal was used for a significant proportion of total TRI chemical releases and transfers.

Here again, large single releases often dominated the totals. For example, 84 percent of the total land releases in Montana came from an individual release of zinc compounds. In these Western states, large individual releases of metals, such as copper and zinc, were disposed of in surface impoundments or "other" types of land release sites. (See discussion below on types of land releases.) Surface impoundments are widely used in the West because continuous days of sunshine

3 From the Occidental Chemical Company in White Springs, Florida (91 million pounds) and the Royster Company in Mulberry, Florida (66 million pounds).

4 Kennecott Utah Copper in Copperton, Utah.

5 Kaiser Aluminum and Chemical, Kaiser Tech Limited, in Gramercy, Louisiana.

evaporate the liquid in the ponds, and the precipitation is low enough so that they do not generally fill up or overflow.

Conversely, land releases comprised less than one percent of total TRI chemical releases and transfers in nine states. The jurisdictions with a low proportion of land releases (including South Dakota, Alaska, Rhode Island, Puerto Rico, Kansas, Michigan, California, and Maine) are not clustered in a distinct geographical region, as are the states with a high proportion of land releases.

Counties

Almost one third of all TRI on-site land releases occurred in two counties in Texas.

Map 8-1 shows how releases to land of TRI chemicals were concentrated in several counties across the U.S. Almost one-third of all on-site land releases were in two counties in Texas: Calhoun County with 454 million pounds and Milam County with 321 million pounds (Table 8-2). The next largest releases to land were in four counties in four different states: Utah, Louisiana, Indiana, and Arkansas. These include counties where the large individual releases mentioned above are located. Land releases in the four counties in these states accounted for one-fifth of on-site land releases in the nation. Together, the top six counties accounted for over half of all on-site land releases of TRI chemicals.

Generally, the states with the largest land releases of TRI chemicals also had land releases concentrated in one or two counties. For instance, releases in Salt Lake County, Utah accounted for 96 percent of the total land releases in Utah. Likewise, releases in St. James County, Louisiana accounted for 96 percent of the total land releases in Louisiana. Some states had more than one county where large land releases occurred. For example, Texas, Indiana, and Alabama each had three counties in the top 25, and Florida, Arizona, Pennsylvania, and Ohio each had 2 counties in the top 25. The 25 counties with the largest land releases of TRI chemicals accounted for 82 percent of on-site land releases nationwide.

TABLE 8-2. THE 25 COUNTIES WITH THE LARGEST TOTAL TRI
ON-SITE LAND RELEASES, 1987

COUNTY	STATE	TOTAL ON-SITE LAND RELEASES	PERCENT OF TOTAL ON-SITE LAND RELEASES IN THE STATE
		Pounds	
CALHOUN	TX	453,791,380	54.34
MILAM	TX	320,737,000	38.41
SALT LAKE	UT	158,463,912	95.77
ST JAMES	LA	149,131,694	96.28
LAKE	IN	108,389,629	43.97
SALINE	AR	103,001,630	94.90
WARRICK	IN	92,500,000	37.52
HAMILTON	FL	91,000,000	47.69
POLK	FL	90,219,440	47.28
COLBERT	AL	53,030,500	54.06
PINAL	AZ	50,371,323	51.87
GILA	AZ	44,232,100	45.55
BUTLER	PA	44,149,899	62.22
JEFFERSON	MO	38,552,438	68.31
LEWIS AND CLARK	MT	31,202,530	96.83
WABASH	IN	30,078,163	12.20
SWEETWATER	WY	23,454,457	96.99
INYO	CA	23,120,000	48.48
COWLITZ	WA	18,800,750	74.89
TRUMBULL	OH	15,336,584	32.18
JEFFERSON	AL	13,622,371	13.89
HARRIS	TX	13,443,758	1.61
DEFIANCE	OH	12,643,375	26.53
BUCKS	PA	12,059,550	17.00
LAWRENCE	AL	12,037,600	12.27
SUBTOTAL		2,003,370,092	
PERCENT OF GRAND TOTAL		81.71	
TOTAL FOR ALL OTHERS		448,519,872	
GRAND TOTAL		2,451,889,964	

Types of Land Releases

A total of 1,886 TRI facilities reported land releases for 1987. The TRI form requested that facilities indicate how their land releases were placed into the environment. The form provided four choices: (1) **landfills**; (2) **surface impoundments** (ponds or pits where liquid wastes are left to evaporate and from which the remaining sludge is removed;⁶ (3) **land treatment, land application, or farming**; and (4) **other disposal**, including leaks and spills.

Although only 14 percent of the facilities which released wastes to land used *surface impoundments* (256 out of 1,886), these facilities disposed of over half of the amount of TRI chemicals released to land (56 percent, or 1.4 billion out of the 2.4 billion pounds of land releases)

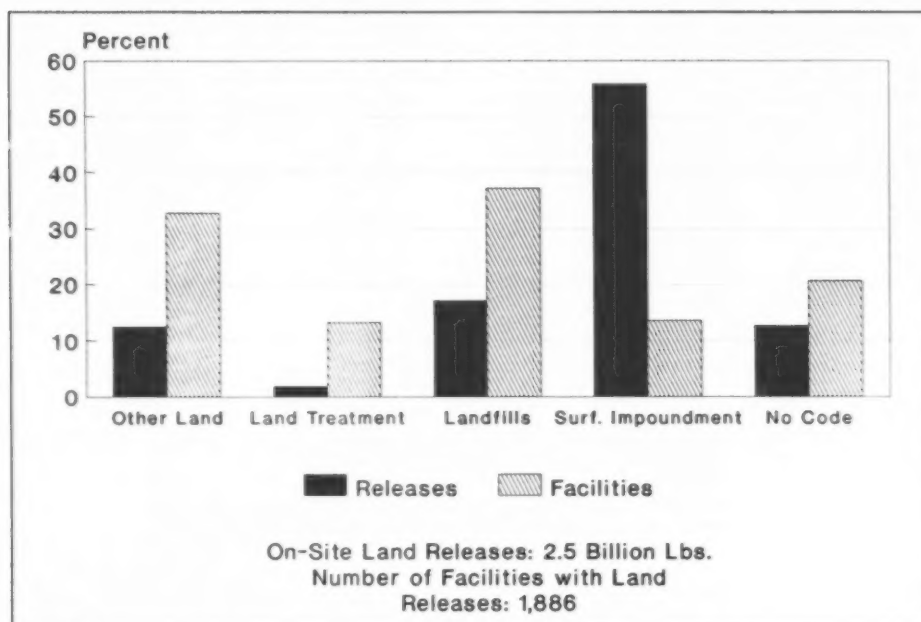


Figure 8-4.

Types of On-Site Land Releases Reported to TRI, 1987.

⁶ Releases to surface impoundments include only those intended for "final disposal," and not where the impoundment is used as an intermediate step in on-site wastewater treatment.

(Figure 8-4, Table 8-3). On the other hand, over one-third of the facilities (699 out of 1,886) reported landfill deposits – more than for any other type of land release – yet the total amount of chemicals released to landfills was 17 percent of the total (419 million pounds).

Over half the total amount of TRI chemicals released on land was disposed of in surface impoundments

Almost 33 percent (618 out of 1,886) of the facilities reporting land disposal released a total of 306 million pounds (12 percent) of *other* releases. The smallest portion of land releases went to *land treatment* (two percent, or 46 million pounds), which were reported by 13 percent of the 1,886 facilities. Reports from approximately 21 percent of the TRI facilities (388 out of 1,886), with approximately 13 percent (250) of the land releases (311 million pounds), did not indicate the type of land release.

Facility use of surface impoundments for disposing of large amounts of TRI chemical wastes is further illustrated by the fact that three-quarters (827 million pounds) of the five largest single land releases were disposed of in surface impoundments. These five top individual releases accounted for 43 percent (1.1 billion pounds out of 2.5 billion pounds) of the total land disposal.

Industries that Released TRI Chemicals to Land

Industrial Distribution

Facilities in the Primary Metals industry disposed of one billion pounds of chemicals on land – 52 percent of all land releases (Figure 8-5, Table 8-4). (See Appendix C for a complete list of industries covered by TRI requirements.) The Primary Metals industry was also the largest producer of off-site releases to land (see Chapter 9). These are the only categories of TRI releases and transfers dominated by an industry other than the Chemical and Allied Products industry. The large amount of land releases by the Primary Metals industry is partly accounted for by large releases of aluminum oxide and copper from two individual facilities that amounted to 451 million pounds, or 44 percent, of the metal industry's TRI land releases.

Facilities in the Primary Metals industry released 52 percent of the TRI total for on-site land disposal.

The Chemical and Allied Products industry reported the second largest amount of chemicals released to land – 900 million pounds, or 37 percent of the total TRI land releases. Together, the Primary Metals and the Chemical industries reported 78 percent of all TRI chemicals released to land. Land release was a significant method of TRI chemical disposal for the Primary Metals industry. Land release was used for 39 percent of the total TRI releases and transfers by this industry, but for only seven percent of the Chemical industry's total TRI releases and transfers.

The Chemical industry ranked second for land disposal with 37 percent of TRI land releases.

TABLE 8-3. AMOUNT OF TRI RELEASES BY TYPE OF ON-SITE LAND RELEASE BY STATE, 1987

TOTAL ON-SITE LAND RELEASE Rank	STATE	RELEASES TO ON-SITE LANDFILLS		RELEASES TO ON-SITE LAND TREATMENT		RELEASES TO ON-SITE SURFACE IMPONEMENTS		RELEASES TO ON-SITE LAND (OTHER)		RELEASES TO ON-SITE LAND (NO CODE)		TOTAL TRI ON-SITE LAND RELEASES Pounds
		Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	
7	Alabama	74,863,421	78.35	3,067,208	3.12	1,494,789	1.52	46,805	0.05	18,600,368	18.86	98,091,592
51	Alaska	0	0.00	0	0.00	0	0.00	14,930	100.00	0	0.00	14,930
53	American Samoa	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
8	Arizona	818,743	0.84	46,000	0.05	54,908,599	56.55	41,228,274	42.48	290	0.00	97,102,866
9	Arkansas	744,313	0.89	35,480	0.03	103,812,056	95.65	419,522	0.39	3,522,023	3.25	108,534,294
11	California	1,522,888	3.19	5,644,315	11.83	34,063,810	71.48	5,939,677	12.39	522,502	1.10	47,863,392
24	Colorado	10,574,598	84.28	32,400	0.26	200,430	1.60	1,736,586	13.86	1,500	0.01	12,547,494
38	Connecticut	1,300,889	81.19	0	0.00	750	0.04	112,308	6.98	234,801	12.89	1,648,678
39	Delaware	204,500	7.87	2,324,200	90.58	28,480	1.11	7,888	0.30	1,017	0.04	2,585,678
3	Florida	5,098,195	2.63	1,531,588	0.80	86,628,632	46.50	6,025,847	3.16	91,412,961	47.80	190,627,201
22	Georgia	7,744,884	51.74	1,848,625	12.35	2,380,867	15.70	295,157	1.70	2,770,100	18.50	14,989,473
48	Hawaii	0	0.00	183,479	77.31	0	0.00	53,883	22.68	0	0.00	237,362
21	Idaho	6,871,000	46.51	1,831,707	12.89	1,675,500	12.51	4,208,400	28.08	1,700	0.01	14,986,307
29	Illinois	8,989,634	58.74	979,517	6.74	1,591,591	14.20	1,494,385	13.33	447,026	3.99	11,209,153
2	Indiana	121,819,558	49.33	2,265,020	0.82	122,101,500	49.53	132,864	0.05	404,810	0.16	246,523,580
43	Iowa	394,482	38.31	750	0.10	67,900	8.63	345,163	44.90	80,407	7.66	768,722
42	Kansas	854,784	81.69	133,187	12.56	26,890	2.52	15,128	1.43	18,822	1.79	1,056,889
33	Kentucky	3,894,822	98.68	111,080	2.78	18,948	0.48	3,672	0.09	337	0.01	4,028,637
5	Louisiana	2,605,127	1.82	1,308,928	0.85	1,594,478	1.03	152,184	0.10	148,013,120	96.20	154,864,637
38	Maine	1,628,350	86.75	208,860	10.16	0	0.00	1,636	0.08	0	0.00	2,037,136
32	Maryland	3,933,859	91.08	367,882	8.52	610	0.01	15,104	0.35	1,270	0.03	4,316,725
35	Massachusetts	2,428,797	87.85	0	0.00	428,822	11.99	717,170	26.08	2,423	0.07	3,575,212
34	Michigan	2,427,562	61.00	191,367	4.81	260,426	6.87	878,842	24.80	118,100	2.92	3,979,327
40	Minnesota	988,481	57.98	688,030	40.42	502	0.03	1,022	0.06	26,080	1.51	1,722,105
35	Mississippi	7,860,233	51.88	28,888	0.18	8,508,237	42.88	750,531	4.83	83,632	0.55	15,252,731
10	Missouri	8,228,478	11.04	1,984	0.00	136,772	0.25	41,103,099	72.63	8,889,717	15.88	56,436,000
13	Montana	840,500	1.88	62,086	0.19	388,448	1.21	31,132,500	96.61	290	0.00	32,223,586
45	Nebraska	25,010	7.13	0	0.00	82,870	23.61	242,300	69.25	0	0.00	349,910
27	Nevada	1,288,000	11.70	0	0.00	6,377,030	56.95	290	0.00	3,174,212	29.34	10,817,482
34	New Hampshire	394,140	88.14	0	0.00	0	0.00	72,388	10.88	0	0.00	466,528
31	New Jersey	3,752,808	71.20	3,000	0.06	750	0.01	1,385,174	26.07	140,970	2.65	5,312,503
19	New Mexico	98,000	0.51	3,174	0.02	2	0.00	17,216,030	99.47	250	0.00	17,307,456
18	New York	14,545,488	82.85	204,385	1.18	133,913	0.78	190,078	1.08	2,524,851	14.35	17,598,716
14	North Carolina	108,017	0.35	751,311	2.48	11,845,128	39.61	17,189,232	56.63	186,280	0.62	30,157,846
41	North Dakota	1,100,250	99.98	290	0.02	0	0.00	0	0.00	0	0.00	1,100,500
12	Ohio	43,270,381	90.78	88,614	0.19	2,026,016	4.25	703,179	1.46	1,575,400	3.31	47,684,580
37	Oklahoma	871,949	35.12	488,574	19.80	62,100	2.50	214,186	8.63	846,090	34.16	2,482,661
23	Oregon	8,947,054	49.83	483,517	3.45	6,522,740	46.80	33,147	0.24	12,305	0.09	13,986,763
6	Pennsylvania	17,883,558	25.20	62,147	0.09	44,386,284	62.55	702,318	0.99	7,823,140	11.17	70,957,429
47	Puerto Rico	0	0.00	500	0.27	5,000	2.72	178,850	97.01	0	0.00	184,150
50	Rhode Island	2,450	3.56	0	0.00	64,781	93.88	1,088	1.58	880	0.99	69,008
28	South Carolina	773,573	8.80	5,830,029	64.81	302,740	3.37	188,631	2.11	1,888,086	21.11	8,994,959
52	South Dakota	0	0.00	0	0.00	9	100.00	0	0.00	0	0.00	9
17	Tennessee	4,008,975	19.51	13,880	0.07	9,579,222	46.61	433,386	2.11	6,515,331	31.70	20,550,544
1	Texas	38,089,039	4.32	5,123,889	0.61	774,526,438	82.75	15,813,463	1.91	3,428,129	0.41	835,967,985
4	Utah	2,808,343	1.58	23,000	0.01	72,197,980	43.63	80,814,152	54.78	23,985	0.01	165,467,430
46	Vermont	0	0.00	0	0.00	0	0.00	37,457	22.20	131,239	77.80	168,696
49	Virgin Islands	18,000	21.71	88,506	78.29	0	0.00	0	0.00	0	0.00	87,505
30	Virginia	2,683,180	41.48	28,000	0.40	3,546,471	51.08	25,148	0.36	464,913	6.69	6,949,712
15	Washington	3,554,566	14.18	410,288	1.63	18,845,967	75.07	183,984	0.73	2,110,200	8.41	25,105,014
25	West Virginia	3,212,577	27.80	8,087,514	69.23	33,080	0.28	3,890	0.03	331,354	2.85	11,638,215
26	Wisconsin	2,850,632	35.18	1,535,989	20.38	39,949	0.53	9,510	0.13	3,298,461	43.79	7,535,521
16	Wyoming	249,290	1.03	29,380	0.12	412,104	1.70	23,454,378	98.98	38,457	0.16	24,183,539
TOTAL		419,200,225	17.10	48,180,325	1.88	1,388,820,712	55.87	305,638,362	12.47	310,835,310	12.88	2,451,689,864

On-site Land Disposal and Underground Injection

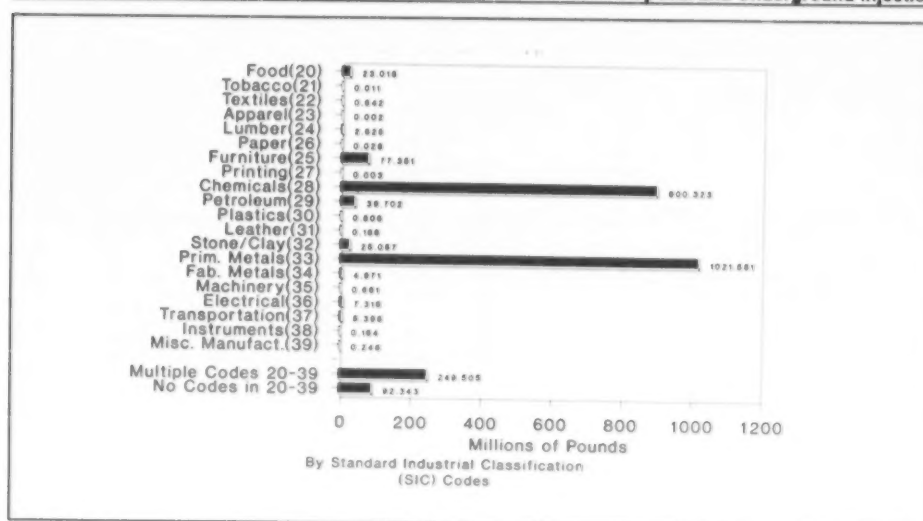


Figure 8-5.
Total Land Releases of TRI Chemicals by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

TABLE 8-4. TRI FACILITIES, FORMS AND AMOUNT OF TOTAL ON-SITE LAND RELEASES BY INDUSTRY, 1987

TOTAL TRI ON-SITE LAND			TOTAL TRI FACILITIES WITH ON-SITE		TOTAL TRI FORMS WITH ON-SITE		TOTAL TRI ON-SITE LAND	
RELEASE	SIC		LAND RELEASES		LAND RELEASES		RELEASES	
Rank	CODE	INDUSTRY	Number	Percent	Number	Percent	Pounds	Percent
8	20	Food Products	141	7.48	233	4.43	23,018,190	0.94
20	21	Tobacco Manufacturers	2	0.11	3	0.06	10,810	0.00
15	22	Textile Mill Products	30	1.59	44	0.84	842,327	0.03
22	23	Apparel	2	0.11	2	0.04	1,500	0.00
12	24	Lumber and Wood Products	75	3.98	170	3.23	2,825,119	0.11
19	25	Furniture and Fixtures	9	0.42	14	0.27	28,105	0.00
5	26	Paper Products	100	5.48	295	5.61	77,350,923	3.15
21	27	Printing, Publishing	4	0.21	4	0.08	2,597	0.00
2	28	Chemicals Products	517	27.41	1,580	30.22	900,323,396	36.72
8	29	Petroleum Refining	103	5.46	664	13.00	39,701,782	1.62
13	30	Rubber and Plastic Products	51	2.70	70	1.33	806,182	0.03
17	31	Leather Products	8	0.32	9	0.17	188,320	0.01
7	32	Stone, Clay, Glass Products	126	6.68	232	4.41	25,056,647	1.02
1	33	Primary Metals	263	13.94	913	17.35	1,021,550,898	41.66
11	34	Fabricated Metals	94	4.98	208	3.95	4,970,842	0.20
14	35	Machinery, except Electrical	38	2.01	64	1.22	680,719	0.03
9	36	Electric and Electronic Equip.	70	3.71	135	2.57	7,315,930	0.30
10	37	Transportation Equipment	49	2.60	116	2.20	5,397,988	0.22
18	38	Measuring, Photographic Goods	12	0.64	27	0.51	184,118	0.01
16	39	Misc. Manufacturing	18	0.95	30	0.57	248,233	0.01
3	Multiple SIC codes in 20 - 39		147	7.79	343	6.52	249,504,529	10.18
4	No SIC codes in 20 - 39		29	1.54	75	1.43	92,342,831	3.77
TOTAL			1,888	100.00	5,281	100.00	2,451,889,984	100.00
PERCENT OF ALL REPORTING			9.78		7.08		10.89	

TABLE 8-5. AMOUNT OF TRI RELEASES BY TYPE OF ON-SITE LAND RELEASE BY INDUSTRY, 1987

TOTAL TRI ON-SITE LAND RELEASE	SIC CODE	INDUSTRY	RELEASES TO ON-SITE LANDFILLS		RELEASES TO ON-SITE LAND TREATMENT		RELEASES TO ON-SITE SURFACE IMPOUNDMENTS	
			PERCENT OF TOTAL ON-SITE		PERCENT OF TOTAL ON-SITE		PERCENT OF TOTAL ON-SITE	
			Pounds	LAND	Pounds	LAND	Pounds	LAND
8	20	Food Products	1,318,297	5.73	12,640,803	54.92	2,075,242	9.02
20	21	Tobacco Manufacturers	0	0.00	0	0.00	370	3.42
15	22	Textile Mill Products	138,201	21.53	103,869	16.17	104,447	16.26
22	23	Apparel	1,500	100.00	0	0.00	0	0.00
12	24	Lumber and Wood Products	2,482,078	94.55	38,143	1.45	58,071	2.21
19	25	Furniture and Fixtures	4,973	17.09	0	0.00	2,500	8.90
5	26	Paper Products	42,898,689	55.46	4,040,097	5.22	8,301,481	10.73
21	27	Printing, Publishing	1,797	69.20	0	0.00	0	0.00
2	28	Chemical Products	27,228,510	3.02	10,169,512	1.13	565,018,119	62.76
6	29	Petroleum Refining	25,353,353	63.66	6,775,217	17.07	1,024,141	2.58
13	30	Rubber and Plastic Products	86,727	10.76	15,864	1.97	4,990	0.62
17	31	Leather Products	1,698	1.02	95,514	57.43	56,990	34.27
7	32	Stone, Clay, Glass Products	22,983,709	91.73	8,420	0.03	1,469,626	5.87
1	33	Primary Metals	179,719,636	17.59	8,269,396	0.81	559,355,698	54.76
11	34	Fabricated Metals	2,561,115	51.52	164,446	3.31	76,921	1.55
14	35	Machinery, except Electrical	609,680	92.28	2,925	0.44	250	0.04
9	36	Electric and Electronic Equip.	4,194,775	57.34	818,911	11.19	176,823	2.42
10	37	Transportation Equipment	756,779	14.02	500	0.01	3,854,794	71.41
18	38	Measuring, Photographic Goods	25,378	15.46	400	0.24	0	0.00
16	39	Misc. Manufacturing	50,512	20.35	400	0.16	9,676	3.90
3		Multiple SIC codes in 20 - 39	108,775,149	43.60	2,998,026	1.20	136,098,553	54.55
4		No SIC codes in 20 - 39	7,589	0.01	52,880	0.06	92,132,010	99.77
TOTAL			419,200,225	17.10	46,195,325	1.88	1,369,820,712	55.87

Some facilities not required to report to TRI did so; such facilities accounted for four percent of the total TRI on-site land releases.

The third largest amount of TRI chemicals released to land, approximately 92 million pounds (four percent of all land releases), came from industries not required to report to TRI because they were not classified as members of SIC Codes 20-39. Land disposal accounted for 62 percent of the total TRI releases and transfers reported by these industries.⁷ Most of this amount was released by a single facility, a public utility⁸ in Indiana. Other industries that released more than 20 million pounds of TRI chemicals on land were: Paper Products with 77 million pounds; Petroleum Refining with 40 million pounds; Stone, Clay, and Glass Products with 25 million pounds; and Food Products with 23 million pounds.

7 Because facilities outside of the general manufacturing industries (SIC Codes 20-39) were not required to report to TRI, the releases shown in this category represent only a fraction of what might have been reported had additional industries been covered by TRI requirements.

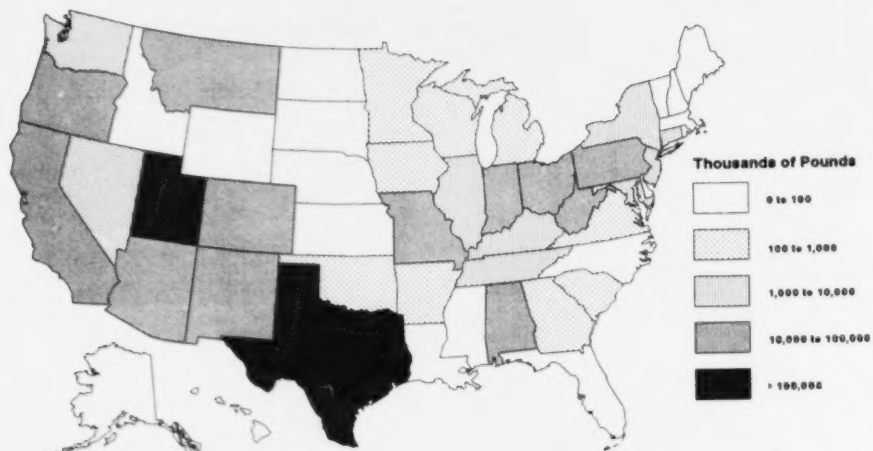
8 SIC Code 49.

TABLE 8-5 (Continued)

SIC CODE	INDUSTRY	RELEASES TO ON-SITE LAND (OTHER)		RELEASES TO ON-SITE LAND (NO CODE)		TOTAL TRI ONSITE LAND RELEASES Pounds
		Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	
20	Food Products	5,431,667	23.60	1,552,181	6.74	23,018,190
21	Tobacco Manufacturers	20	0.19	10,420	96.39	10,810
22	Textile Mill Products	22,363	3.48	273,367	42.56	642,327
23	Apparel	0	0.00	0	0.00	1,500
24	Lumber and Wood Products	31,596	1.20	15,231	0.58	2,625,119
25	Furniture and Fixtures	400	1.42	20,232	71.99	26,105
26	Paper Products	9,299,640	12.02	12,811,006	16.56	77,350,923
27	Printing, Publishing	800	30.80	0	0.00	2,597
28	Chemical Products	47,599,092	5.29	250,308,163	27.80	900,323,396
29	Petroleum Refining	5,966,335	15.03	582,736	1.47	39,701,782
30	Rubber and Plastic Products	14,452	1.79	684,129	84.86	606,162
31	Leather Products	530	0.32	11,588	6.97	166,320
32	Stone, Clay, Glass Products	506,189	2.02	88,703	0.35	25,056,647
33	Primary Metals	234,643,826	22.97	39,562,342	3.87	1,021,550,898
34	Fabricated Metals	639,219	12.86	1,529,139	30.76	4,970,842
35	Machinery, except Electrical	12,511	1.89	35,353	5.35	660,719
36	Electric and Electronic Equip.	115,661	1.58	2,009,780	27.47	7,315,930
37	Transportation Equipment	535,640	9.92	250,275	4.64	5,397,988
38	Measuring, Photographic Good	76,734	46.76	61,604	37.54	164,116
39	Misc. Manufacturing	185,465	74.71	2,180	0.88	248,233
	Multiple SIC codes in 20 - 39	740,560	0.30	892,241	0.36	249,504,529
	No SIC codes in 20 - 39	15,692	0.02	134,660	0.15	92,342,631
TOTAL		305,838,392	12.47	310,835,310	12.68	2,451,889,964

The uses of different land release methods varied from industry to industry. Many industries, including the Primary Metals and Chemical industries, deposited the largest fraction of their land releases into surface impoundments, following the overall pattern noted above (Table 8-5). Facilities in the Petroleum Refining industry, however, placed the largest amount of their land releases into landfills—25 out of 40 million pounds. Facilities in both the Paper and Allied Products and the Stone, Clay, and Glass Products industries also placed the largest fractions of their land releases into landfills—55 percent (43 out of 77 million pounds) and 91 percent (23 out of 25 million pounds), respectively. Food Products facilities placed the largest portion of their land releases in land treatment—55 percent (13 million pounds out of 23 million pounds).

Map 8-2, on the following page, illustrates the geographical distribution of releases to land by the Primary Metals industry. Releases to land were highest in Texas, several Western states, and several states in the Great Lakes area.



Map 8-2.
Releases of TRI Chemicals to Land by the Primary Metals Industry, 1987

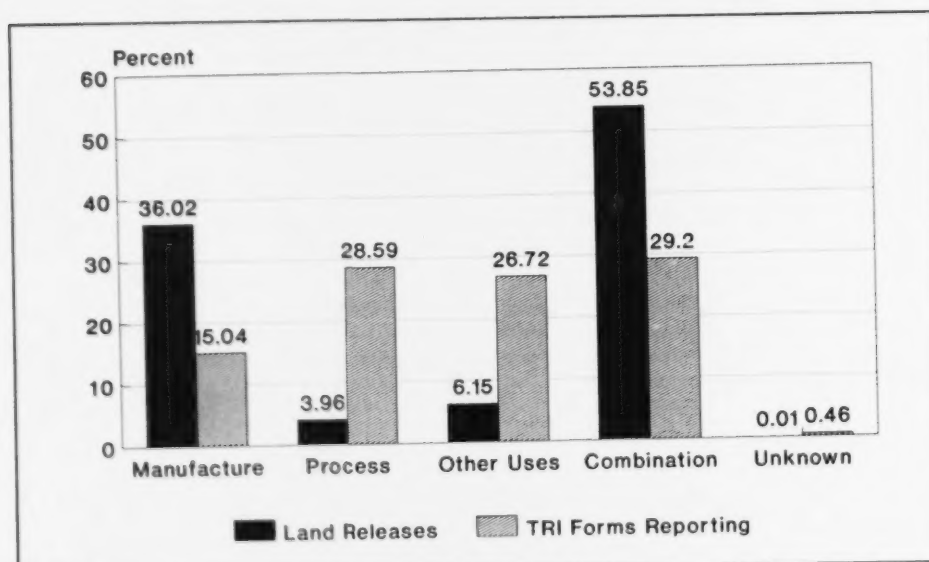


Figure 8-6.
TRI Land Releases by Industrial Activities and Uses, 1987.

Industrial Activities and Uses

Facilities engaged in *manufacture only* submitted 15 percent of the TRI forms reporting land releases, yet they disposed of 36 percent of the total amount of TRI chemicals (Figure 8-6). Facilities reporting *processing only* or *other uses only* submitted 29 percent and 27 percent, respectively, of the TRI forms reporting land releases, but accounted for only small percentages of total land releases—four percent and six percent, respectively. Over half of all land releases occurred at facilities that reported combined uses (reported in 29 percent of the forms).

Facilities reporting "manufacture only" as their use of TRI chemicals released over one third of the total TRI land releases.

TRI Chemicals Disposed of on Land

Aluminum oxide was released to land in larger amounts than any other TRI chemical in 1987. This metal compound comprised 57 percent (1.4 billion pounds) of all TRI land releases (Table 8-6). Aluminum oxide may be removed from the TRI chemical list for future reporting years. (See Chapter 4, Box 4-A.)

Aluminum oxide made up 57 percent of all TRI land releases.

Five other chemicals were released to land in amounts greater than 90 million pounds: phosphoric acid (187 million pounds), copper (138 million pounds), sodium hydroxide (131 million pounds), zinc compounds (106 million pounds), and sodium sulfate (91 million pounds). These five chemicals, combined with aluminum oxide, accounted for 84 percent (2.0 billion pounds) of all TRI land releases. The top 25 chemicals, listed in Table 8-6, represent 99 percent of the total amount of TRI chemicals released to land.

Of the 272 TRI chemicals for which releases and transfers were reported, 81 (30 percent) were not released on land (Table 8-7).

Chemical Classes

The largest amounts of TRI chemicals released to land belong to two chemical classes—metals and metal compounds and acids/bases/salts. Three of the five chemicals released to land in the largest amounts were metals or metal compounds (aluminum oxide, copper, and zinc compounds). Metals comprised three-quarters of the total TRI land releases—1.8 out of 2.5 billion pounds (Figure 8-7). In contrast, metal releases made up only 15 percent of total TRI releases and transfers (See Chapter 4, Figure 4-1). The acids/bases/salts class made up another 23 percent of the TRI land releases. Non-metals, organics, and halo-organics each accounted for one percent, or less, of the TRI land releases (Table 8-8).

Metals and metal compounds made up three quarters of all TRI land releases.

TABLE 8-6. NUMBER OF TRI FORMS AND AMOUNT OF RELEASES FOR THE 25 CHEMICALS WITH THE LARGEST TOTAL ON-SITE LAND RELEASES, 1987

TOTAL TRI RELEASE/ TRANSFER	CHEMICAL NAME	TOTAL TRI FORMS WITH ON-SITE LAND RELEASES		TOTAL TRI ON-SITE LAND RELEASES	
		Number	Percent	Pounds	Percent
2	ALUMINUM OXIDE	340	6.46	1,393,735,259	56.84
10	PHOSPHORIC ACID	114	2.17	187,196,716	7.63
15	COPPER	110	2.09	138,313,940	5.64
6	SODIUM HYDROXIDE (SOLUTION)	383	7.28	131,481,032	5.36
16	ZINC COMPOUNDS	137	2.60	106,238,413	4.33
1	SODIUM SULFATE (SOLUTION)	156	2.97	91,199,023	3.72
5	SULFURIC ACID	214	4.07	79,173,009	3.23
23	ZINC (FUME OR DUST)	79	1.50	44,081,364	1.80
21	MANGANESE COMPOUNDS	89	1.69	33,932,193	1.38
32	COPPER COMPOUNDS	79	1.50	32,542,294	1.33
29	LEAD	99	1.88	19,902,748	0.81
36	HYDROGEN FLUORIDE	19	0.36	19,183,998	0.78
44	CHROMIUM COMPOUNDS	139	2.64	18,993,625	0.77
20	AMMONIUM NITRATE (SOLUTION)	63	1.20	15,076,212	0.61
8	METHANOL	116	2.20	14,702,600	0.60
38	MANGANESE	92	1.75	14,236,822	0.58
46	LEAD COMPOUNDS	97	1.84	13,202,242	0.54
49	ARSENIC COMPOUNDS	15	0.29	13,045,465	0.53
4	HYDROCHLORIC ACID	118	2.24	12,114,031	0.49
22	NITRIC ACID	55	1.05	8,914,511	0.36
54	BARIUM COMPOUNDS	38	0.72	7,654,406	0.31
3	AMMONIUM SULFATE (SOLUTION)	39	0.74	7,249,407	0.30
63	BARIUM	28	0.53	7,004,752	0.29
7	AMMONIA	138	2.62	4,967,305	0.20
58	NICKEL COMPOUNDS	80	1.52	4,656,651	0.19
	SUBTOTAL	2,837	53.93	2,418,798,018	98.65
	TOTAL FOR ALL OTHERS	2,424	46.07	33,091,946	1.35
	GRAND TOTAL	5,261	100.00	2,451,889,964	100.00

TABLE 8-7. TRI CHEMICALS FOR WHICH NO ON-SITE LAND RELEASES WERE REPORTED, 1987
(Of the 272 chemicals for which some releases were reported)

1	1,1-DIMETHYL HYDRAZINE	41	DICHLOROBROMOMETHANE
2	1,2-BUTYLENE OXIDE	42	DICHLORVOS
3	2,4,6-TRICHLOROPHENOL	43	DICOFOL
4	2,4-DIAMINOANISOLE	44	DIETHYL PHTHALATE
5	2,4-DIAMINOANISOLE SULFATE	45	DIMETHYL SULFATE
6	2,4-DIAMINOTOLUENE	46	ETHYL CHLOROFORMATE
7	2,6-XYLIDINE	47	ETHYLENE THIOUREA
8	2-CHLOROACETOPHENONE	48	ETHYLENEIMINE
9	2-NITROPHENOL	49	FLUOMETURON
10	2-NITROPROPANE	50	HEPTACHLOR
11	3,3'-DICHLOROBENZIDINE	51	HEXACHLOROBENZENE
12	4,4'-DIAMINODIPHENYL ETHER	52	HEXACHLOROCYCLOPENTADIENE
13	4,4'-METHYLENEBIS(2-CHLORO ANILINE)	53	HYDRAZINE SULFATE
14	4,4'-METHYLENEBIS(N,N-DIMETHYL)	54	MANEB
15	4,6-DINITRO-O-CRESOL	55	METHYL HYDRAZINE
16	4-AMINOAZOBENZENE	56	METHYL IODIDE
17	4-AMINOBIPHENYL	57	METHYL ISOCYANATE
18	5-NITRO-O-ANISIDINE	58	METHYLENE BROMIDE
19	ACETAMIDE	59	MICHLER'S KETONE
20	ALLYL CHLORIDE	60	NITROGEN MUSTARD
21	ALPHA-NAPHTHYLAMINE	61	N-NITROSODIPHENYLAMINE
22	BENZAL CHLORIDE	62	PERACETIC ACID
23	BENZOIC TRICHLORIDE	63	PHOSGENE
24	BENZOYL CHLORIDE	64	POLY BROMINATED BIPHENYLS
25	BERYLLIUM COMPOUNDS	65	PROPANE SULTONE
26	BIS(CHLOROMETHYL) ETHER	66	PROPOXUR
27	BROMOMETHANE	67	PROPYLENEIMINE
28	CARBONYL SULFIDE	68	P-ANISIDINE
29	CHLORAMBEN	69	P-NITROSODIPHENYLAMINE
30	CHLORDANE	70	QUINONE
31	CHLOROACETIC ACID	71	QUINTOZENE
32	CHLOROBENZILATE	72	SACCHARIN (MANUFACTURING)
33	CHLOROMETHYL METHYL ETHER	73	SAFROLE
34	CHLOROPHENOLS	74	STYRENE OXIDE
35	CHLOROPRENE	75	TETRACHLORVINPHOS
36	CHLOROTHALONIL	76	THALLIUM
37	CUPFERRON	77	THALLIUM COMPOUNDS
38	C.I. ACID BLUE 9, DIAMMONIUM SALT	78	THORIUM DIOXIDE
39	C.I. BASIC GREEN 4	79	TRICHLORFON
40	C.I. SOLVENT YELLOW 14	80	VINYL BROMIDE
		81	ZINEB

TABLE 8-8. TRI ON-SITE RELEASES TO LAND BY CHEMICAL CLASS, 1987

		RELEASES TO ON-SITE LANDFILLS		RELEASES TO ON-SITE LAND TREATMENT			
TOTAL TRI RELEASE/ TRANSFER		TOTAL TRI ONSITE LAND RELEASES	PERCENT OF TOTAL ON-SITE	PERCENT OF TOTAL ON-SITE			
Rank	CHEMICAL NAME	Pounds	Percent	Pounds	LAND	Pounds	LAND
Acids/Bases/Salts							
1	SODIUM SULFATE (SOLUTION)	91,199,023	3.72	10,867,370	2.59	11,993,246	25.96
		7,249,407	0.30	899,188	0.21	1,801,007	3.90
3	AMMONIUM SULFATE (SOLUTION)	12,114,031	0.49	10,983	0.00	1,593,754	3.45
4	HYDROCHLORIC ACID	79,173,009	3.23	2,825,047	0.67	695,533	1.51
5	SULFURIC ACID	131,481,032	5.36	2,007,728	0.48	7,068,299	15.30
6	SODIUM HYDROXIDE (SOLUTION)	187,196,716	7.63	866,453	0.21	4,073,710	8.82
10	PHOSPHORIC ACID						
	Subtotal	508,413,218	20.74	17,476,769	4.17	27,225,549	58.94
	TOTAL FOR ALL OTHERS IN CLASS	43,192,671	1.76	6,642,938	1.58	1,248,821	2.70
	TOTAL FOR CLASS	551,605,889	22.50	24,119,707	5.75	28,474,370	61.64
Halo-organics							
14	1,1,1-TRICHLOROETHANE	199,061	0.01	76,572	0.02	50	0.00
17	DICHLOROMETHANE	67,621	0.00	7,801	0.00	1,000	0.00
25	FREON 113	22,562	0.00	2,584	0.00	0	0.00
26	TRICHLOROETHYLENE	70,411	0.00	2	0.00	411	0.00
35	TETRACHLOROETHYLENE	4,746	0.00	331	0.00	0	0.00
	Subtotal	364,401	0.02	87,290	0.02	1,461	0.00
	TOTAL FOR ALL OTHERS IN CLASS	320,146	0.01	195,174	0.05	59,068	0.13
	TOTAL FOR CLASS	684,547	0.03	282,464	0.07	60,529	0.13
Metals and Metal Compounds							
2	ALUMINUM OXIDE	1,393,735,259	56.84	275,745,426	65.78	1,927,782	4.17
15	COPPER	138,313,940	5.64	1,092,227	0.26	22,874	0.05
16	ZINC COMPOUNDS	106,236,413	4.33	26,445,436	6.31	8,104,578	17.54
21	MANGANESE COMPOUNDS	33,932,193	1.38	28,950,971	6.91	100,252	0.22
23	ZINC (FUME OR DUST)	44,061,364	1.80	9,969,455	2.38	397,223	0.86
	Subtotal	1,716,301,169	70.00	342,203,517	81.63	10,552,709	22.84
	TOTAL FOR ALL OTHERS IN CLASS	128,549,614	5.24	41,522,766	9.91	1,330,474	2.88
	TOTAL FOR CLASS	1,844,850,783	75.24	383,726,283	91.54	11,883,183	25.72
Non-metallic Inorganics							
7	AMMONIA	4,967,305	0.20	216,852	0.05	1,443,686	3.13
19	CHLORINE	1,529,801	0.06	1,000	0.00	510,129	1.10
49	ARSENIC COMPOUNDS	13,045,465	0.53	501	0.00	500	0.00
50	ASBESTOS (FRIABLE)	3,676,021	0.15	3,101,071	0.74	0	0.00
57	CHLORINE DIOXIDE	133,371	0.01	250	0.00	52,161	0.11
	Subtotal	23,351,963	0.95	3,319,674	0.79	2,006,476	4.34
	TOTAL FOR ALL OTHERS IN CLASS	4,125,234	0.17	95,814	0.02	250	0.00
	TOTAL FOR CLASS	27,477,197	1.12	3,415,288	0.81	2,006,726	4.34
Organics (non-halogenated)							
8	METHANOL	14,702,600	0.60	5,605,583	1.34	1,647,601	3.57
9	TOLUENE	1,747,264	0.07	97,965	0.02	132,571	0.29
11	ACETONE	258,979	0.01	101,686	0.02	41,241	0.09
12	XYLENE (MIXED ISOMERS)	644,953	0.03	66,530	0.02	293,164	0.63
13	METHYL ETHYL KETONE	88,763	0.00	13,243	0.00	4,994	0.01
	Subtotal	17,442,559	0.71	5,885,007	1.40	2,119,571	4.59
	TOTAL FOR ALL OTHERS IN CLASS	8,757,248	0.36	1,620,255	0.39	1,489,293	3.18
	TOTAL FOR CLASS	26,199,807	1.07	7,505,262	1.79	3,598,864	7.77
34	TOTAL FOR MIXTURES	1,026,691	0.04	148,471	0.04	181,653	0.40
100	TOTAL FOR TRADE SECRETS	45,050	0.00	2,750	0.00	0	0.00
	GRAND TOTAL	2,451,889,964	100.00	419,200,225	100.00	46,195,325	100.00

On-site Land Disposal and Underground Injection

TABLE 8-8. (Continued)

CHEMICAL NAME	RELEASES TO ON-SITE SURFACE IMPOUNDMENTS		RELEASES TO ON-SITE LAND (OTHER)		RELEASES TO ON-SITE LAND (NO CODE)	
	Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND	Pounds	PERCENT OF TOTAL ON-SITE LAND
Acids, Bases and Salts						
SODIUM SULFATE (SOLUTION)	33,081,118	2.41	28,963,482	9.47	8,293,807	2.02
AMMONIUM SULFATE (SOLUTION)	4,413,256	0.32	135,708	0.04	250	0.00
HYDROCHLORIC ACID	8,808,219	0.64	1,020,959	0.33	880,118	0.22
SULFURIC ACID	71,988,308	5.25	1,711,205	0.56	1,972,918	0.83
SODIUM HYDROXIDE (SOLUTION)	107,980,281	7.88	12,675,263	4.14	1,748,461	0.56
PHOSPHORIC ACID	80,964,868	5.91	10,217,240	3.34	91,074,445	29.30
Subtotal	307,216,048	22.43	54,723,855	17.89	101,770,997	32.74
TOTAL FOR ALL OTHERS IN CLASS	31,888,485	2.33	360,981	0.12	3,051,446	0.98
TOTAL FOR CLASS	339,104,533	24.76	55,084,836	18.01	104,822,443	33.72
Halo-organics						
1,1,1-TRICHLOROETHANE	1,750	0.00	83,401	0.03	37,288	0.01
DICHLOROMETHANE	1,000	0.00	44,420	0.01	13,400	0.00
FREON 113	0	0.00	19,963	0.01	15	0.00
TRICHLOROETHYLENE	3	0.00	30,684	0.01	39,311	0.01
TETRACHLOROETHYLENE	2,971	0.00	1,434	0.00	10	0.00
Subtotal	5,724	0.00	179,902	0.06	90,024	0.03
TOTAL FOR ALL OTHERS IN CLASS	21,479	0.00	40,368	0.01	4,059	0.00
TOTAL FOR CLASS	27,203	0.00	220,268	0.07	94,083	0.03
Metals and Metal Compounds						
ALUMINUM OXIDE	922,898,443	67.38	4,064,521	1.33	189,299,085	60.90
COPPER	55,556,218	4.06	81,418,648	26.62	221,973	0.07
ZINC COMPOUNDS	9,320,820	0.68	61,869,484	20.23	498,095	0.18
MANGANESE COMPOUNDS	4,012,912	0.29	867,808	0.28	250	0.00
ZINC (FUME OR DUST)	4,160,751	0.30	29,207,817	9.55	346,118	0.11
Subtotal	995,751,144	72.89	177,428,278	58.01	190,365,521	61.24
TOTAL FOR ALL OTHERS IN CLASS	20,953,173	1.53	56,002,615	18.31	8,740,586	2.82
TOTAL FOR CLASS	1,016,704,317	74.22	233,430,893	76.32	199,106,107	64.06
Non-metal Inorganics						
AMMONIA	2,973,669	0.22	199,908	0.07	133,190	0.04
CHLORINE	914,429	0.07	43,798	0.01	60,445	0.02
ARSENIC COMPOUNDS	6,910,163	0.50	6,134,301	2.01	0	0.00
ASBESTOS (FRIABLE)	26,750	0.00	151,800	0.05	396,400	0.13
CHLORINE DIOXIDE	62,440	0.00	250	0.00	18,270	0.01
Subtotal	10,887,451	0.79	6,530,057	2.14	608,305	0.20
TOTAL FOR ALL OTHERS IN CLASS	34,242	0.01	3,986,718	1.30	8,410	0.00
TOTAL FOR CLASS	10,921,693	0.80	10,516,775	3.44	616,715	0.20
Organics (non-halogenated)						
METHANOL	1,637,831	0.12	126,525	0.04	5,885,260	1.83
TOLUENE	70,483	0.01	1,441,832	0.47	4,413	0.00
ACETONE	49,762	0.00	34,921	0.01	31,369	0.01
XYLENE (MIXED ISOMERS)	6,885	0.00	260,774	0.09	17,600	0.01
METHYL ETHYL KETONE	501	0.00	22,514	0.01	47,511	0.02
Subtotal	1,785,262	0.13	1,886,566	0.62	5,786,153	1.88
TOTAL FOR ALL OTHERS IN CLASS	800,472	0.06	4,458,454	1.46	406,774	0.13
TOTAL FOR CLASS	2,585,734	0.19	6,345,020	2.08	6,192,927	1.99
TOTAL FOR MIXTURES	454,932	0.03	240,600	0.08	1,035	0.00
TOTAL FOR TRADE SECRETS	42,300	0.00	0	0.00	0	0.00
GRAND TOTAL	1,369,820,712	100.00	305,838,392	100.00	310,835,310	100.00

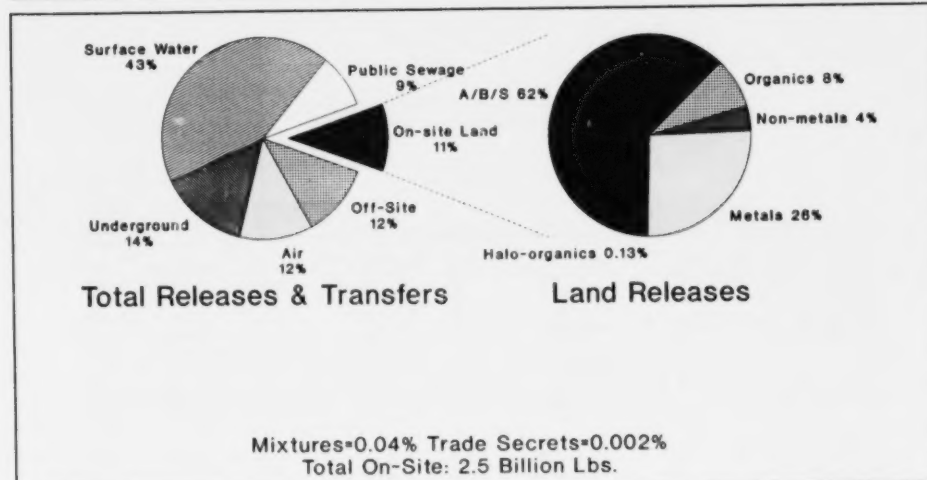


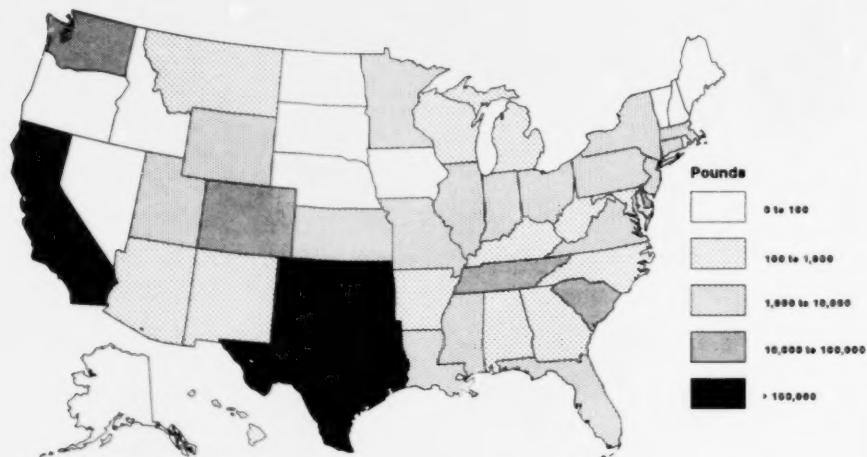
Figure 8-7.
Chemical Class Breakdown of TRI Land Releases, 1987.

Selected Chemicals

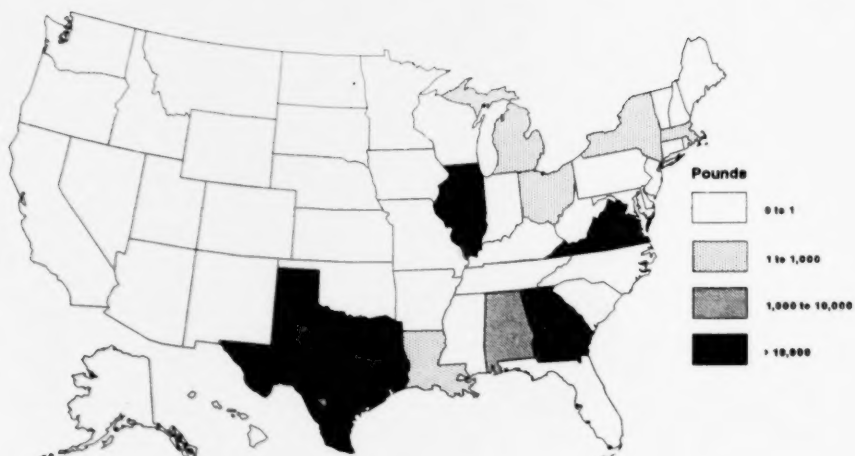
Land disposal of individual chemicals shows a different geographical pattern than for the total set of TRI chemicals. Maps 8-3 through 8-8 illustrate the distribution of releases to land of toluene, trichloroethylene, aluminum oxide, asbestos, arsenic compounds, and metals and metal compounds. Comparing land releases of toluene (Map 8-3) with overall TRI totals (Map 5-3) shows that land releases of toluene are more concentrated in the Southwest and California while total TRI releases and transfers of toluene are found largely in the Great Lake and Mid-Atlantic states. Trichloroethylene land releases (Map 8-4), on the other hand, are reported in just a few states which are, like the total TRI releases and transfers pattern for this chemical (Map 5-4), found in the Midwest and South.

Facilities in the Great Lakes, Gulf Coast, and Northwest states reported large releases of aluminum oxide.

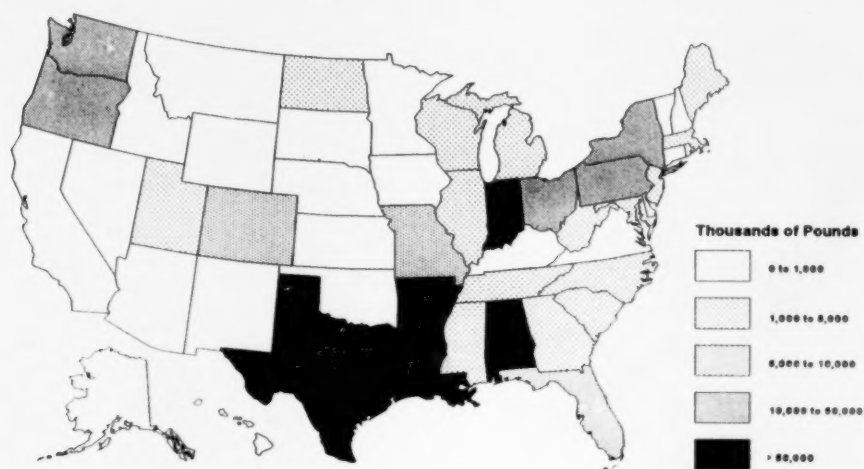
While all of the selected chemicals shown in Maps 8-3 through 8-8 had large land releases in Texas, the overall geographical distribution of land releases varied in other states. For example, large land releases of aluminum oxide were reported in the Great Lakes, Gulf Coast, and Northwest states. The largest land releases of asbestos were in the South Central states, a few Great Lakes states, Virginia, and Vermont—very little was reported in other parts of the country. Arsenic compounds, however, were released to land in the largest amounts in several Western states and Missouri. Metals and metal compounds were released in the largest amounts in several Western states, several South Central states, and several Great Lakes states.



Map 8-3.
TRI Land Releases of Toluene Reported to TRI, 1987.



Map 8-4.
TRI Land Releases of Trichloroethylene Reported to TRI, 1987.



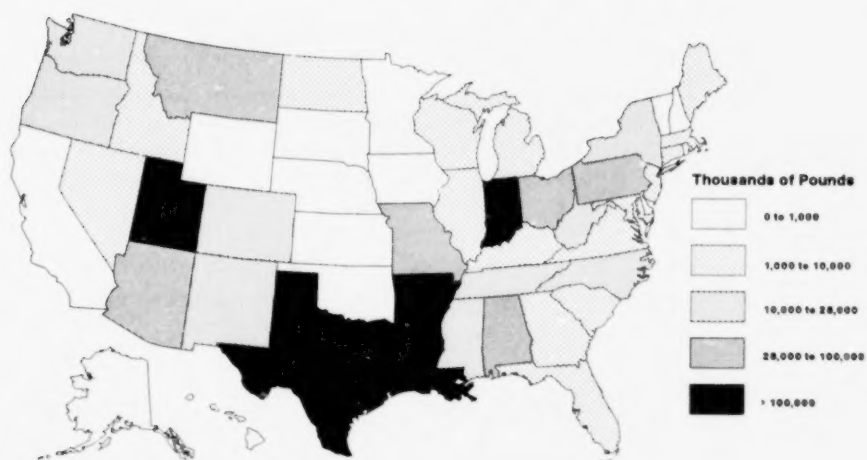
Map 8-5.
TRI Land Releases of Aluminum Oxide, 1987.



Map 8-6.
TRI Land Releases of Asbestos, 1987.



Map 8-7.
TRI Land Releases of Arsenic Compounds Reported to TRI, 1987.



Map 8-8.
TRI Land Releases of Metals and Metal Compounds Reported to TRI, 1987.

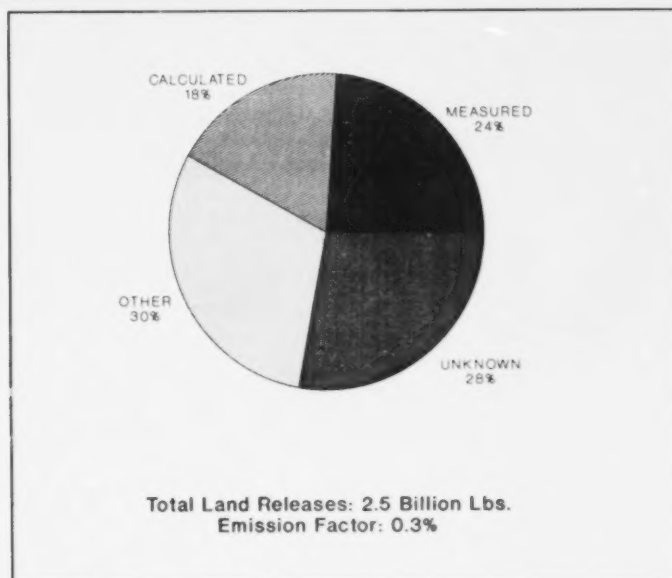


Figure 8-8.
Basis of Estimate for Land Releases of TRI Chemicals, 1987.

Basis of Estimate for Land Releases

Approximately one-quarter of the total amount of reported TRI land releases was measured (Figure 8-8). The remaining land releases were estimated by calculation (18 percent), emission factors (0.3 percent), or other methods (30 percent). Methods used to estimate 28 percent of releases to land were unknown.

UNDERGROUND INJECTION

The other major form of disposal to land was injection of liquid chemical wastes in underground wells. Although used by only 185 TRI facilities (less than one percent of all TRI facilities), underground injection accounted for 14 percent (3.2 billion pounds) of the total TRI releases and transfers. In addition, 95 million pounds of chemicals transferred to off-site facilities for treatment, storage, or disposal were injected into underground wells (see Chapter 9, Table 9-4).

Only 185 facilities reported disposing of TRI chemicals through underground injection, but these releases amounted to 3.2 billion pounds of TRI chemicals.

Geographical Distribution of Underground Injection

States

A total of 185 facilities in only 34 jurisdictions reported injecting TRI chemical wastes into on-site underground wells. Texas contained the most underground injection sites, with 38 facilities reporting underground injection (Table 8-9). Louisiana had the second highest number of underground injection sites (22 sites), followed by Michigan (14), California (11), Illinois (8), and Indiana (8). Facilities in many Midwestern and Western states and New England did not report any underground injection; many states do not have appropriate geological conditions to support this method of chemical waste disposal.⁹

Facilities in only 34 states reported using underground injection to dispose of TRI chemicals.

While California ranked third for the number of facilities using underground injection, facilities in the state lead the country for the total amount of TRI chemicals released by underground injection (Figure 8-9). Nationwide releases were dominated by underground injections of 1.5 billion pounds of sodium sulfate by a single California facility.¹⁰ This single release dwarfs all other underground injections—it accounted for almost half of the total amount of TRI chemicals injected underground; it was nearly ten times larger than any other single underground injection reported in the nation; and it raised California to the top of the state ranking. Without this release, California would

Underground injection releases were dominated by the injection of 1.5 billion pounds of sodium sulfate by a single facility in California.

⁹ Underground injection requires certain geological conditions, including a porous layer approximately one mile deep, through which wastes can disperse, topped by a layer of clay that serves to seal and separate the porous layer from near-to-the-surface groundwater.

¹⁰ A Kerr-McGee facility in Trona, California.

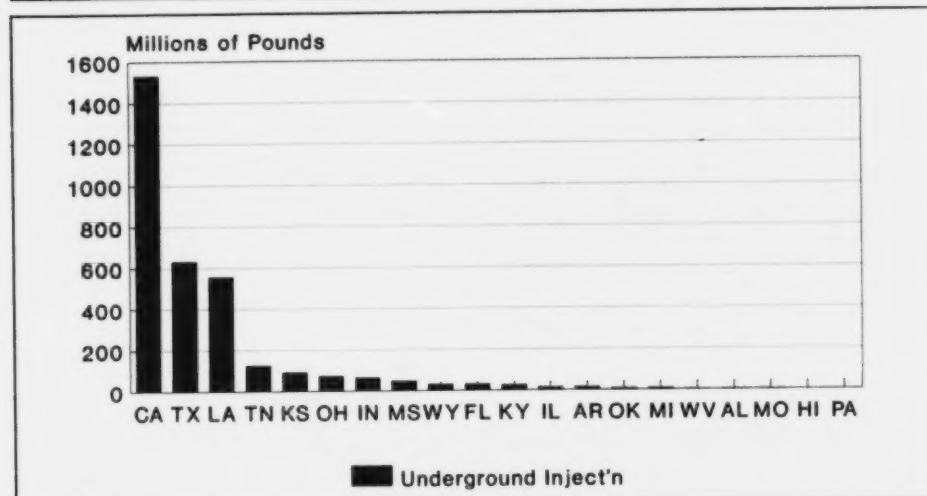


Figure 8-9.
The 20 States with the Largest Underground Injection of TRI Chemicals, 1987.

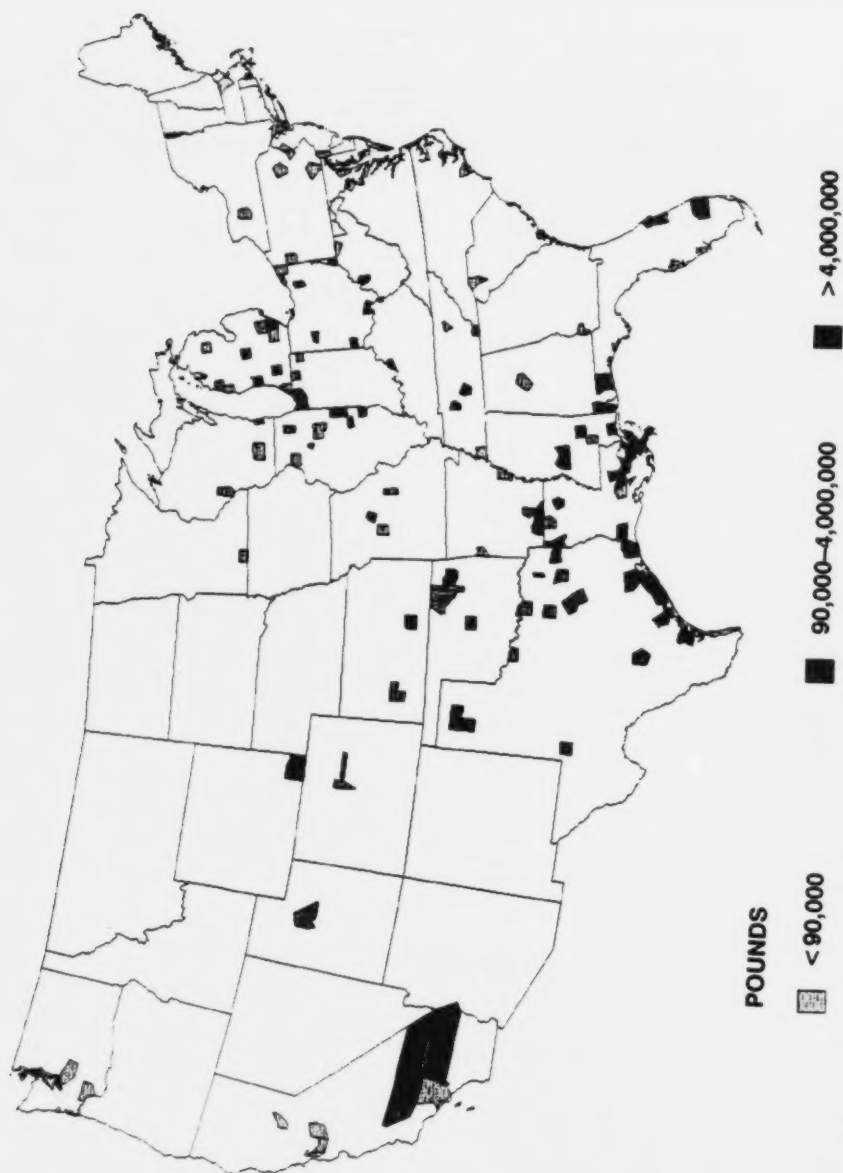
Facilities in Texas and Louisiana released over one third of the total TRI on-site underground injection.

have ranked 16th for total underground injection amounts, with releases of less than two million pounds.¹¹

Texas and Louisiana facilities injected the next largest amounts of TRI chemicals into underground wells. Facilities in Texas released 630 million pounds, and facilities in Louisiana released 554 million pounds. When combined, the two states accounted for over one-third of the total underground injections of TRI chemicals, and if California's single large injection is excluded, Louisiana and Texas would account for over two-thirds of the nation's on-site underground injections of TRI chemicals (Map 8-9). Tennessee, Kansas, Ohio, and Indiana followed, each with underground injections of between 60 and 125 million pounds.

The six facilities releasing the largest amounts of a single chemical by underground injection were located in California (one facility) – as noted, this facility's 1.5 billion-pound sodium sulfate release topped the list – Texas (two facilities), and Louisiana (three facilities). Combined, the five Texas and Louisiana facilities accounted for 20 percent of the total underground injection of TRI chemicals.

¹¹ As noted in Chapter 4, sodium sulfate may be removed from the TRI list. For further information on the dominant role played by sodium sulfate overall see also Chapter 4, Box 4-D, and Chapter 5, Box 5-C.



Map 8-9. Total On-Site Underground Injection of TRI Chemicals Reported Nationwide, by County, 1987.

[Note: As this report went to press, EPA learned that an off-site transfer of TRI chemicals in Georgia was inadvertently reported as an underground injection release. There were no underground injection releases in this state reported to TRI.]

Chapter 8

TABLE 8-9. TRI FACILITIES, FORMS AND AMOUNT OF UNDERGROUND INJECTION RELEASES BY STATE, 1987

UNDERGROUND INJECTION RELEASE	STATE	TRI FACILITIES REPORTING UNDERGROUND INJECTION RELEASES		TRI FORMS REPORTING UNDERGROUND INJECTION RELEASES		AMOUNT OF TRI UNDERGROUND INJECTION RELEASES	
		Number	Percent	Number	Percent	Pounds	Percent
17	Alabama	3	1.82	13	1.78	1,443,591	0.04
	- Alaska	0	0.00	0	0.00	0	0.00
	- American Samoa	0	0.00	0	0.00	0	0.00
	- Arizona	0	0.00	0	0.00	0	0.00
13	Arkansas	8	4.32	19	2.60	13,016,449	0.40
1	California	11	5.95	26	3.56	1,530,850,645	47.21
23	Colorado	2	1.08	2	0.27	1,170	0.00
	- Connecticut	0	0.00	0	0.00	0	0.00
32	Delaware	1	0.54	1	0.14	250	0.00
10	Florida	5	2.70	33	4.52	29,437,389	0.91
21	Georgia	1	0.54	1	0.14	19,500	0.00
19	Hawaii	2	1.08	5	0.68	216,140	0.01
	- Idaho	0	0.00	0	0.00	0	0.00
12	Illinois	8	4.32	19	2.60	14,221,970	0.44
7	Indiana	8	4.32	30	4.11	63,356,466	1.95
	- Iowa	0	0.00	0	0.00	0	0.00
5	Kansas	3	1.62	36	4.93	91,067,410	2.81
11	Kentucky	2	1.08	2	0.27	25,000,250	0.77
3	Louisiana	22	11.89	126	17.26	553,820,180	17.08
	- Maine	0	0.00	0	0.00	0	0.00
26	Maryland	1	0.54	1	0.14	750	0.00
34	Massachusetts	1	0.54	1	0.14	250	0.00
15	Michigan	14	7.57	50	6.85	6,472,752	0.20
33	Minnesota	1	0.54	1	0.14	250	0.00
8	Mississippi	6	3.24	9	1.23	46,433,140	1.43
18	Missouri	3	1.62	3	0.41	1,001,450	0.03
	- Montana	0	0.00	0	0.00	0	0.00
	- Nebraska	0	0.00	0	0.00	0	0.00
	- Nevada	0	0.00	0	0.00	0	0.00
	- New Hampshire	0	0.00	0	0.00	0	0.00
25	New Jersey	4	2.16	4	0.55	780	0.00
	- New Mexico	0	0.00	0	0.00	0	0.00
29	New York	2	1.08	2	0.27	500	0.00
31	North Carolina	1	0.54	1	0.14	250	0.00
	- North Dakota	0	0.00	0	0.00	0	0.00
6	Ohio	7	3.78	30	4.11	71,850,645	2.22
14	Oklahoma	6	3.24	20	2.74	7,171,133	0.22
	- Oregon	0	0.00	0	0.00	0	0.00
20	Pennsylvania	4	2.16	4	0.55	74,000	0.00
24	Puerto Rico	1	0.54	1	0.14	988	0.00
	- Rhode Island	0	0.00	0	0.00	0	0.00
27	South Carolina	1	0.54	1	0.14	750	0.00
	- South Dakota	0	0.00	0	0.00	0	0.00
4	Tennessee	7	3.78	24	3.29	124,406,900	3.84
2	Texas	38	20.54	245	33.56	630,223,666	19.44
35	Utah	1	0.54	1	0.14	3	0.00
	- Vermont	0	0.00	0	0.00	0	0.00
	- Virgin Islands	0	0.00	0	0.00	0	0.00
30	Virginia	1	0.54	1	0.14	250	0.00
28	Washington	2	1.08	2	0.27	500	0.00
16	West Virginia	3	1.62	4	0.55	1,719,219	0.05
22	Wisconsin	4	2.16	6	0.82	1,500	0.00
9	Wyoming	1	0.54	6	0.82	30,651,671	0.95
TOTAL		185	100.00	730	100.00	3,242,462,757	100.00
PERCENT OF ALL REPORTING		0.96		0.98		14.40	

Underground Injection Compared to State Total TRI Releases

Underground injection played a major role in overall TRI chemical releases and transfers in only a few states. Underground injection in Kansas accounted for almost half of the total TRI releases and transfers in the state (see Chapter 5, Table 5-2). Underground injection by a single facility in Wyoming accounted for 49 percent of the total TRI chemical releases and transfers in the state. Other states where underground injection comprised a large percentage of total TRI releases and transfers were Louisiana (32 percent), California (26 percent), Texas (23 percent), and Tennessee (21 percent). In Kentucky, Ohio, Indiana, and Mississippi, underground injection accounted for approximately one tenth of the total amounts of TRI chemicals released and transferred.

Counties

Map 8-9 shows the concentration of underground injection releases in several counties. The top 25 counties accounted for 97 percent of all TRI underground injection releases. Within individual states, the releases were also concentrated in these counties. San Bernardino County, California, had more than 99 percent of that state's underground injection releases—1.5 billion pounds (Table 8-10), 99.9 percent of which was the large sodium sulfate release by one facility in the county. St. Charles County, Louisiana, was second with 225 million pounds (41 percent of underground injection releases in that state). The counties with the next largest underground injection releases were Jefferson County, Louisiana, with 216 million pounds (40 percent of the state's underground injection total) and Jefferson County, Texas, with 180 million pounds (29 percent of the state's underground injection total). Two-thirds of all TRI underground injection releases occurred in these four counties.

Two thirds of all on-site TRI underground injection occurred in four counties in California, Louisiana, and Texas.

TABLE 8-10. THE 25 COUNTIES WITH THE LARGEST TRI
UNDERGROUND INJECTION RELEASES, 1987

COUNTY	STATE	PERCENT OF TRI UNDERGROUND INJECTION RELEASES	
		UNDERGROUND INJECTION RELEASES Pounds	IN THE STATE
SAN BERNARDINO	CA	1,530,705,635	99.99
ST CHARLES	LA	224,967,781	40.62
JEFFERSON	LA	216,257,250	39.05
JEFFERSON	TX	180,655,474	28.67
BRAZORIA	TX	177,803,200	28.21
CALHOUN	TX	108,271,200	17.18
SEDGWICK	KS	91,067,160	100.00
GALVESTON	TX	80,457,940	12.77
ASCENSION	LA	74,770,693	13.50
HUMPHREYS	TN	62,200,000	50.00
MAURY	TN	60,191,200	48.38
ALLEN	OH	58,588,750	81.54
HARRISON	MS	39,600,000	85.28
HARRIS	TX	33,394,993	5.30
LARAMIE	WY	30,651,671	100.00
LA PORTE	IN	30,071,815	47.46
JEFFERSON	KY	25,000,000	100.00
ESCAMBIA	FL	22,397,400	76.08
PORTER	IN	21,256,667	33.55
VICTORIA	TX	18,691,650	2.97
LAKE	IN	12,026,924	18.98
ST JAMES	LA	10,106,253	1.82
HARRISON	TX	9,859,130	1.56
SCIOTO	OH	8,973,595	12.49
UNION	AR	8,951,344	68.77
SUBTOTAL		3,136,917,725	
PERCENT OF GRAND TOTAL		96.74	
TOTAL FOR ALL OTHERS		105,545,032	
GRAND TOTAL		3,242,462,757	

Industries that Disposed of TRI Chemicals by Underground Injection

Industrial Distribution

Facilities in the Chemical and Allied Products industry injected the largest amount of TRI chemicals into underground wells, releasing 2.9 billion pounds—90 percent of the total amount of TRI chemicals discharged through this route (Figure 8-10, Table 8-11). Over half of this amount (1.5 billion pounds) was released by the single facility in California described above. Even discounting this large individual release, however, facilities in the Chemical industry contributed 80 percent of the total underground injection releases of TRI chemicals; furthermore, each of the four largest releases (other than the large release in California) also came from facilities in the Chemical industry.

The Chemical industry accounted for 90 percent of the amount of TRI chemicals disposed of by underground injection.

Facilities classified in more than one industry type (more than one SIC Code) ranked a distant second for underground injection of TRI chemicals, with seven percent of the releases (218 million pounds). Facilities in the Primary Metals industry released approximately three percent (90 million pounds) of the total TRI chemicals injected into

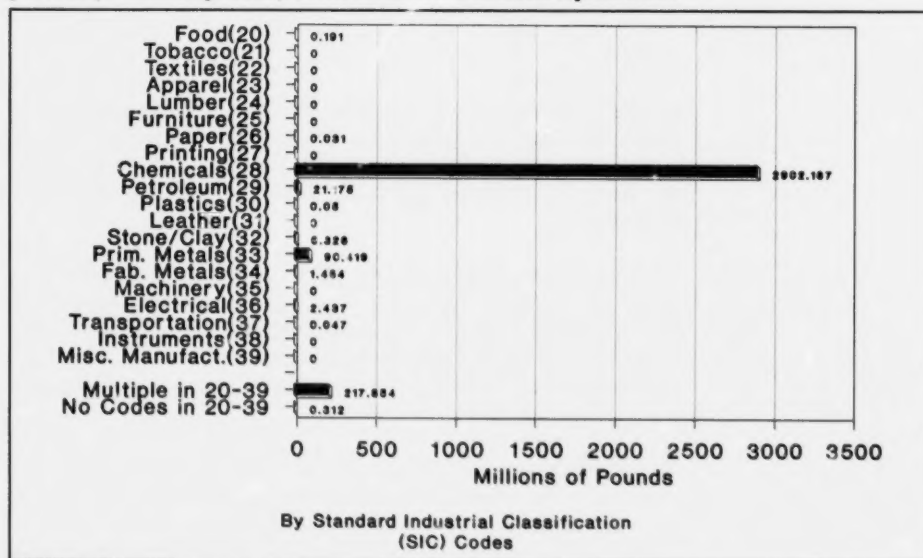


Figure 8-10. TRI Underground Injection Releases of TRI Chemicals by Industry, 1987. By Standard Industrial Classification (SIC) Codes.

TABLE 8-11. TRI FACILITIES, FORMS AND AMOUNT OF UNDERGROUND INJECTION RELEASES BY INDUSTRY, 1987

UNDERGROUND INJECTION RELEASE		SIC CODE	INDUSTRY	TRI FACILITIES REPORTING		TRI FORMS REPORTING		AMOUNT OF	
				UNDERGROUND INJECTION RELEASES		UNDERGROUND INJECTION RELEASES		TRI UNDERGROUND INJECTION RELEASES	
Rank				Number	Percent	Number	Percent	Pounds	Percent
9	20	Food Products		6	3.24	9	1.23	190,566	0.01
-	21	Tobacco Manufacturers		0	0.00	0	0.00	0	0.00
-	22	Textile Mill Products		0	0.00	0	0.00	0	0.00
-	23	Apparel		0	0.00	0	0.00	0	0.00
-	24	Lumber and Wood Products		0	0.00	0	0.00	0	0.00
-	25	Furniture and Fixtures		0	0.00	0	0.00	0	0.00
12	26	Paper Products		3	1.62	5	0.68	30,894	0.00
-	27	Printing, Publishing		0	0.00	0	0.00	0	0.00
1	28	Chemical Products		96	51.86	506	69.59	2,902,166,936	89.51
4	29	Petroleum Refining		13	7.03	54	7.40	21,174,667	0.65
10	30	Rubber and Plastic Products		3	1.62	6	0.82	49,600	0.00
-	31	Leather Products		0	0.00	0	0.00	0	0.00
5	32	Stone, Clay, Glass Products		5	2.70	5	0.68	6,326,300	0.20
3	33	Primary Metals		19	10.27	56	7.67	90,416,540	2.79
7	34	Fabricated Metals		9	4.86	12	1.64	1,453,671	0.04
-	35	Machinery, except Electrical		0	0.00	0	0.00	0	0.00
6	36	Electric and Electronic Equip.		7	3.78	22	3.01	2,437,306	0.08
11	37	Transportation Equipment		3	1.62	6	0.82	47,339	0.00
-	38	Measuring, Photographic Goo		0	0.00	0	0.00	0	0.00
13	39	Misc. Manufacturing		1	0.54	1	0.14	250	0.00
2	Multiple SIC codes in 20 - 39			14	7.57	38	5.21	217,854,136	6.72
8	No SIC codes in 20 - 39			6	3.24	8	1.10	312,352	0.01
TOTAL				185	100.00	730	100.00	3,242,462,757	100.00
PERCENT OF ALL REPORTING				0.96		0.98		14.40	

underground wells. The Petroleum Refining industry released 21 million pounds (0.7 percent); the Stone, Clay, and Glass Products industry released 6 million pounds (0.2 percent); and the Electrical and Electronic Equipment industry released 2 million pounds (0.08 percent).

Facilities in nine industries did not use underground injection for TRI chemicals, and the total underground injection amounts for each of four additional industries were less than 100,000 pounds. In sum, underground injection plays an important role in disposal of TRI chemicals in only a limited number of industries, just as it played a role in only a limited number of states.

Map 8-10 illustrates the geographical distribution of underground injection by the Chemical and Allied Products industry. Facilities in twenty-three states reported underground injection by the Chemical and Allied Products industry. California had the highest releases (with 1.5 billion pounds), followed by Texas and Louisiana (with releases of 614 million pounds and 339 million pounds respectively).



Map 8-10.
Underground Injection of TRI Chemicals by the Chemical and Allied Products Industry, 1987.

Industrial Activities and Uses

Over 80 percent of all underground injection releases occurred at facilities engaged in *manufacture only* activities (Figure 8-11, following page). These facilities submitted only one-quarter of the TRI forms reporting on-site underground injection of specific chemicals. Only three percent of underground injection releases were at facilities engaged in *process only* activities and two percent were at facilities engaged in *other uses only*; however, these facilities submitted nearly half of the TRI chemical forms reporting on-site underground injection. Facilities reporting *combined uses* submitted 28 percent of the forms reporting underground injection and accounted for 13 percent of underground injection releases.

Facilities reporting "manufacture only" of TRI chemicals disposed of over 80 percent of the amount of on-site underground injection reported to TRI

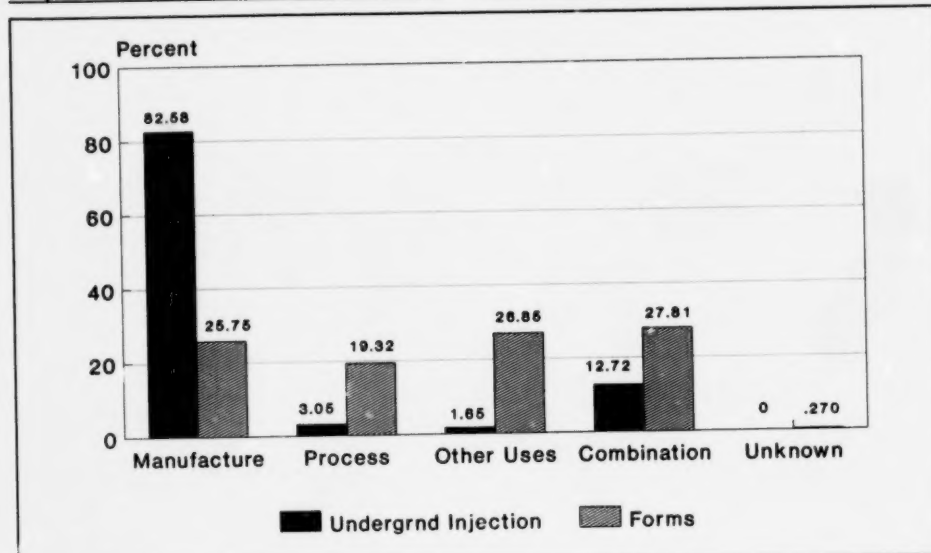


Figure 8-11.
TRI Underground Injection by Industrial Activities and Uses, 1987.

Sodium sulfate dominated releases to underground injection wells.

Chemicals Injected into Underground Wells

Sodium sulfate dominated releases of TRI chemicals to underground injection wells, accounting for 54 percent (1.7 billion pounds) of all TRI injection releases (Table 8-12). Ammonium sulfate and hydrochloric acid were injected underground in the second and third largest amounts, with releases of 611 and 413 million pounds, respectively. If the single large underground injection from the one facility in California is ignored, underground injection of sodium sulfate would total 210 million pounds and its rank would drop to third, behind ammonium sulfate and hydrochloric acid.

Other chemicals injected underground in relatively large amounts included sulfuric acid (136 million pounds), ammonium nitrate (59 million pounds), and aluminum oxide (57 million pounds). The top 25 chemicals accounted for 99 percent of all underground injection releases. Of the 272 chemicals for which TRI releases were reported, no underground injection releases were reported for 124 chemicals, or 46 percent (Table 8-13).

TABLE 8-12. NUMBER OF TRI FORMS AND AMOUNT OF RELEASES FOR THE 25 CHEMICALS WITH THE LARGEST UNDERGROUND RELEASES, 1987

TOTAL TRI RELEASE/ TRANSFER	CHEMICAL NAME	TRI FORMS REPORTING UNDERGROUND INJECTION RELEASES		AMOUNT OF TRI UNDERGROUND INJECTION RELEASES	
		Number	Percent	Pounds	Percent
1	SODIUM SULFATE (SOLUTION)	33	4.52	1,738,973,178	53.63
3	AMMONIUM SULFATE (SOLUTION)	12	1.64	611,231,000	18.85
4	HYDROCHLORIC ACID	42	5.75	413,453,666	12.75
5	SULFURIC ACID	27	3.70	135,999,729	4.19
20	AMMONIUM NITRATE (SOLUTION)	7	0.96	58,565,000	1.81
2	ALUMINUM OXIDE	4	0.55	56,724,250	1.75
7	AMMONIA	29	3.97	47,783,820	1.47
6	SODIUM HYDROXIDE (SOLUTION)	38	5.21	34,336,640	1.06
47	ACRYLIC ACID	6	0.82	27,264,250	0.84
8	METHANOL	31	4.25	19,582,087	0.60
51	ACETONITRILE	11	1.51	17,263,442	0.53
21	MANGANESE COMPOUNDS	5	0.68	10,800,800	0.33
22	NITRIC ACID	10	1.37	9,187,612	0.28
40	PHENOL	17	2.33	7,721,468	0.24
48	FORMALDEHYDE	8	1.10	6,409,150	0.20
64	CYANIDE COMPOUNDS	8	1.10	5,247,763	0.16
30	ETHYLENE GLYCOL	15	2.05	4,843,362	0.15
60	ACRYLONITRILE	11	1.51	4,539,962	0.14
69	DIETHANOLAMINE	3	0.41	3,159,500	0.10
11	ACETONE	16	2.19	2,280,943	0.07
61	VINYL ACETATE	3	0.41	2,109,378	0.07
104	NITRILOTRIACETIC ACID	1	0.14	1,900,000	0.06
72	ACETALDEHYDE	6	0.82	1,568,090	0.05
9	TOLUENE	26	3.56	1,520,943	0.05
56	1,2-DICHLOROETHANE	11	1.51	1,462,844	0.05
	SUBTOTAL	380	52.05	3,223,928,877	99.43
	TOTAL FOR ALL OTHERS	350	47.95	18,533,780	0.57
	GRAND TOTAL	730	100.00	3,242,462,757	100.00

Chemical Classes

Most TRI chemicals injected underground in large amounts belong to the acids/bases/salts class. Although acids/bases/salts comprised 69 percent of total TRI chemical releases and transfers (see Chapter 4, Figure 4-1), they constituted 93 percent (3.0 billion pounds) of all reported underground injection releases of TRI chemicals (Figure 8-12, Table 8-14). Excluding the one sodium sulfate release in California, the class still accounted for 86 percent of the total amount of TRI underground injection releases. No other chemical class accounted for greater than 111 million pounds (3 percent) of TRI underground injection releases.

Acids/bases/salts constituted 93 percent of all TRI on-site underground injection releases.

TABLE 8-13. TRI CHEMICALS FOR WHICH NO UNDERGROUND INJECTION RELEASES WERE REPORTED, 1987
(Of the 272 chemicals for which some releases were reported)

1	1,1,2,2-TETRACHLOROETHANE	63	ETHYL ACRYLATE
2	1,1,2-TRICHLOROETHANE	64	ETHYL CHLOROFORMATE
3	1,1-DIMETHYL HYDRAZINE	65	ETHYLENE
4	1,2-BUTYLENE OXIDE	66	ETHYLENE THIOUREA
5	1,3-BUTADIENE	67	ETHYLENEIMINE
6	1,3-DICHLOROBENZENE	68	FLUOMETURON
7	1,3-DICHLOROPROPYLENE	69	HEPTACHLOR
8	1,4-DIOXANE	70	HYDRAZINE
9	2,4-D (ACETIC ACID)	71	ISOBUTYRALDEHYDE
10	2,4-DIAMINOANISOLE	72	LINDANE
11	2,4-DIAMINOANISOLE SULFATE	73	MANE?
12	2,4-DIAMINOTOLUENE	74	MERCURY
13	2,6-XYLIDINE	75	METHOXYCHLOR
14	2-CHLOROACETOPHENONE	76	METHYL ACRYLATE
15	2-ETHOXYETHANOL	77	METHYL HYDRAZINE
16	2-NITROPHENOL	78	METHYL ISOCYANATE
17	2-PHENYLPHENOL	79	METHYLENE BROMIDE
18	3,3'-DICHLOROBENZIDINE	80	METHYLENEBIS(PHENYLISOCYANATE)
19	4,4'-DIAMINODIPHENYL ETHER	81	MICHLER'S KETONE
20	4,4'-METHYLENEBIS(2-CHLORO ANILINE)	82	MOLYBDENUM TRIOXIDE
21	4,4'-METHYLENEBIS(N,N-DIMETHYL)	83	M-CRESOL
22	4,6-DINITRO-O-CRESOL	84	M-XYLENE
23	5-NITRO-O-ANISIDINE	85	NITROGEN MUSTARD
24	ACETAMIDE	86	NITROGLYCERIN
25	ALPHA-NAPHTHYLAMINE	87	N,N-DIMETHYLANILINE
26	ANTHRACENE	88	N-DIOCTYL PHTHALATE
27	ARSENIC	89	O-ANISIDINE
28	BARIUM	90	O-CRESOL
29	BENZAL CHLORIDE	91	O-XYLENE
30	BENZOIC TRICHLORIDE	92	PARATHION
31	BERYLLIUM	93	PERACETIC ACID
32	BERYLLIUM COMPOUNDS	94	PHOSPHORUS (YELLOW OR WHITE)
33	BIS(2-CHLOROETHYL) ETHER	95	PHTHALIC ANHYDRIDE
34	BIS(2-ETHYLHEXYL) ADIPATE	96	PICRIC ACID
35	BIS(CHLOROMETHYL) ETHER	97	POLY BROMINATED BIPHENYLS
36	BUTYL ACRYLATE	98	PROPANE SULFONE
37	BUTYL BENZYL PHTHALATE	99	PROPOXUR
38	CADMIUM COMPOUNDS	100	PROPYLENE
39	CALCIUM CYANAMIDE	101	PROPYLENEIMINE
40	CARBARYL	102	P-ANISIDINE
41	CARBONYL SULFIDE	103	P-CRESIDINE
42	CATECHOL	104	P-CRESOL
43	CHLORAMBEN	105	P-XYLENE
44	CHLORINE DIOXIDE	106	QUINOLINE
45	CHLOROBENZILATE	107	QUINONE
46	CHLOROMETHYL METHYL ETHER	108	QUINTOZENE
47	CHLOROTHALONIL	109	SACCHARIN (MANUFACTURING)
48	COBALT	110	SAFROLE
49	COBALT COMPOUNDS	111	SELENIUM
50	CUPFERRON	112	STYRENE OXIDE
51	C.I. ACID BLUE 9, DIAMMONIUM SALT	113	TEREPHTHALIC ACID
52	C.I. ACID BLUE 9, DISODIUM SALT	114	TETRACHLORVINPHOS
53	C.I. BASIC GREEN 4	115	THALLIUM
54	C.I. SOLVENT YELLOW 14	116	THALLIUM COMPOUNDS
55	C.I. SOLVENT YELLOW 3	117	THORIUM DIOXIDE
56	DIBENZOFURAN	118	TITANIUM TETRACHLORIDE
57	DICHLOROBROMOMETHANE	119	TOLUENE-2,4-DIISOCYANATE
58	DICHLORVOS	120	TRICHLORFON
59	DICOFOL	121	URETHANE
60	DIETHYL PHTHALATE	122	VANADIUM (FUME OR DUST)
61	DIETHYL SULFATE	123	VINYL BROMIDE
62	DIMETHYL SULFATE	124	ZINEB

TABLE 8-14. TRI UNDERGROUND INJECTION RELEASES
BY CHEMICAL CLASS, 1987

TOTAL TRI RELEASE/ TRANSFER	CHEMICAL NAME	AMOUNT OF TRI UNDERGROUND INJECTION RELEASES Pounds	PERCENT OF TRI UNDERGROUND INJECTION RELEASES
Rank			
Acids, Bases and Salts			
1	SODIUM SULFATE (SOLUTION)	1,738,973,178	53.83
3	AMMONIUM SULFATE (SOLUTION)	611,231,000	18.85
4	HYDROCHLORIC ACID	413,453,666	12.75
5	SULFURIC ACID	135,999,729	4.19
6	SODIUM HYDROXIDE (SOLUTION)	34,336,640	1.06
10	PHOSPHORIC ACID	73,704	0.00
	Subtotal	2,934,067,917	90.49
	TOTAL FOR ALL OTHERS IN CLASS	74,717,245	2.30
	TOTAL FOR CLASS	3,008,785,162	92.79
Halo-organics			
14	1,1,1-TRICHLOROETHANE	28,325	0.00
17	DICHLOROMETHANE	560,000	0.02
25	FREON 113	617	0.00
26	TRICHLOROETHYLENE	18,720	0.00
35	TETRACHLOROETHYLENE	354,000	0.01
	Subtotal	961,662	0.03
	TOTAL FOR ALL OTHERS IN CLASS	2,325,841	0.07
	TOTAL FOR CLASS	3,287,503	0.10
Metals and Metal Compounds			
2	ALUMINUM OXIDE	56,724,250	1.75
15	COPPER	452,890	0.01
16	ZINC COMPOUNDS	707,666	0.02
21	MANGANESE COMPOUNDS	10,800,800	0.33
23	ZINC (FUME OR DUST)	189,574	0.01
	Subtotal	68,875,180	2.12
	TOTAL FOR ALL OTHERS IN CLASS	806,548	0.03
	TOTAL FOR CLASS	69,681,728	2.15
Non-metal Inorganics			
7	AMMONIA	47,783,820	1.47
19	CHLORINE	84,439	0.00
49	ARSENIC COMPOUNDS	1,454,635	0.04
50	ASBESTOS (FRIABLE)	252,000	0.01
57	CHLORINE DIOXIDE	0	0.00
	Subtotal	49,574,894	1.53
	TOTAL FOR ALL OTHERS IN CLASS	99,821	0.00
	TOTAL FOR CLASS	49,674,715	1.53
Organics (non-halogenated)			
8	METHANOL	19,582,087	0.60
9	TOLUENE	1,520,943	0.05
11	ACETONE	2,280,943	0.07
12	XYLENE (MIXED ISOMERS)	586,751	0.02
13	METHYL ETHYL KETONE	75,250	0.00
	Subtotal	24,045,974	0.74
	TOTAL FOR ALL OTHERS IN CLASS	86,873,177	2.68
	TOTAL FOR CLASS	110,919,151	3.42
34	TOTAL FOR MIXTURES	112,000	0.01
100	TOTAL FOR TRADE SECRETS	2,500	0.00
	GRAND TOTAL	3,242,462,757	100.00

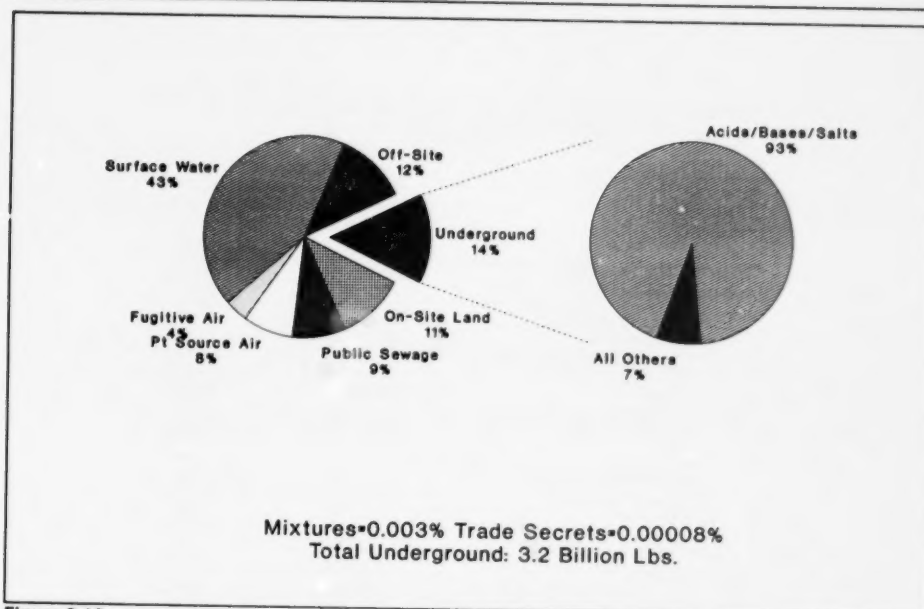


Figure 8-12.
Chemical Class Breakdown of TRI Underground Injection, 1987. Total underground injection: 3.2 billion pounds. Mixtures and Trade Secrets each made up less than one percent of the total.

Selected Chemicals

Underground injection of TRI chemicals was used in a limited number of states. Maps 8-11 through 8-15 show the distribution of underground injection sites of toluene, trichloroethylene, sodium sulfate, formaldehyde, and metals and metal compounds. In comparison to total TRI releases and transfers underground injection of toluene (Map 5-3) and trichloroethylene (Map 5-4), underground injection releases of toluene (Map 8-11) and trichloroethylene (Map 8-12) are concentrated in a few states. But these states are the same as those states also showing relatively large overall total TRI releases and transfers of toluene and trichloroethylene.

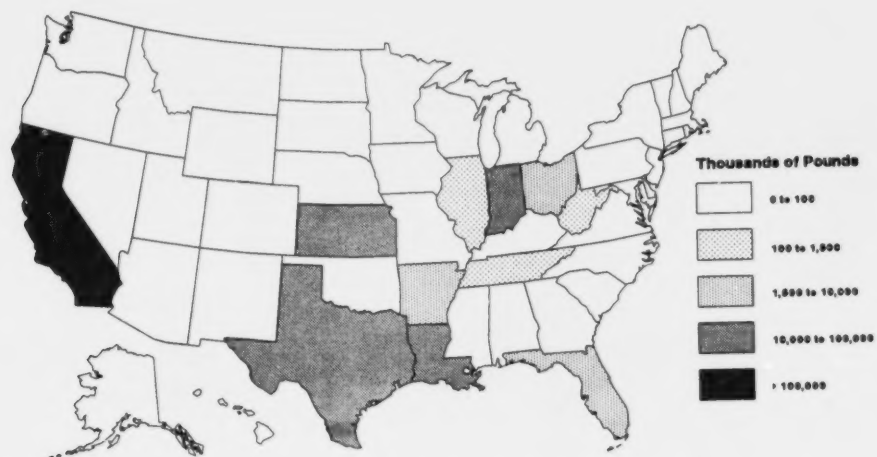
In general for underground injection releases sodium sulfate and toluene were injected underground in the largest amounts in the South Central and Great Lakes areas, California, and Florida. Underground injection of metals and metal compounds was highest in the South Central, Southeast, and Great Lakes areas. Formaldehyde and trichloroethylene were injected underground primarily in Kansas, Texas, and Louisiana.



Map 8-11.
Underground Injection of Toluene Reported to TRI, 1987.



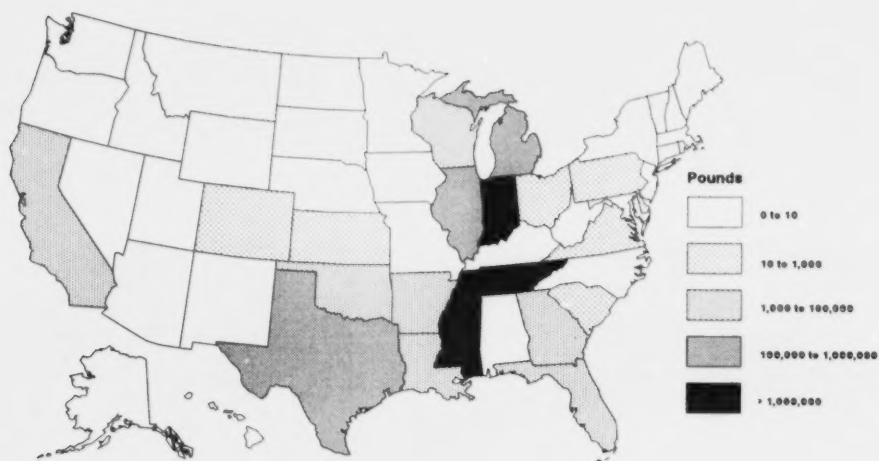
Map 8-12.
Underground Injection of Trichloroethylene Reported to TRI, 1987.



Map 8-13.
Underground Injection of Sodium Sulfate Reported to TRI, 1987.



Map 8-14.
Underground Injection of Formaldehyde Reported to TRI, 1987.



Map 8-15.
Underground Injection of Metals and Metal Compounds Reported to TRI, 1987.

Basis of Estimate for Underground Injections

Release amounts for approximately half of all underground injections reported to TRI were obtained by calculation (Figure 8-13). Another one-quarter (22 percent) was measured; the remainder were estimated by emission factors (0.05 percent), other methods (16 percent), or unknown methods (10 percent).

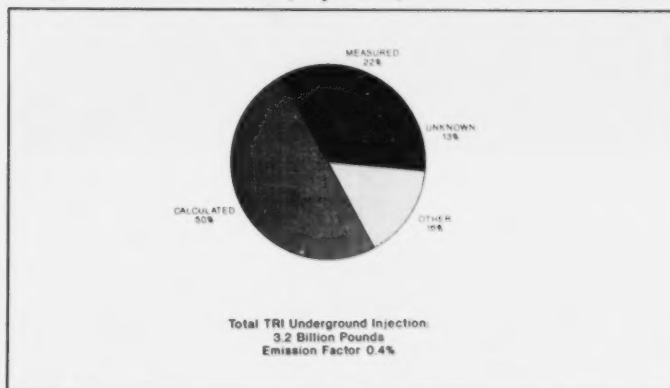


Figure 8-13.
Basis of Estimate for Underground Injection of TRI Chemicals, 1987.

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Chapter 9. Off-site Transfers of Chemical Wastes

Introduction

Fifty percent of facilities filing reports under the Toxics Release Inventory (TRI) (9,686 out of 19,278 facilities) reported transferring some or all of their wastes containing TRI chemicals to off-site facilities (other than public sewage systems) that treated, stored, or disposed of the wastes. Forty-three percent of all TRI forms reporting releases and transfers for 1987 (27,575 forms) noted such off-site transfers.¹ TRI chemical wastes transferred to off-site facilities totalled 2.6 billion pounds—12 percent of the total TRI chemicals reported released or transferred (Figure 9-1).

Manufacturers transferred 2.6 billion pounds of TRI chemicals off-site in 1987 for treatment or disposal.

The fate of chemicals transferred to off-site facilities varies. Off-site facilities may store or release chemicals to the environment in essentially the same form in which the chemicals were received. Chemicals may, for example, be deposited directly in landfills or injected into off-site or on-site underground wells (see Chapter 8). Alternatively, off-site facilities may subject chemicals to varying degrees and types of treatment to reduce the amount and toxicity of chemicals that are released to the environment.

Waste treatment may also transform the way in which chemicals are released. For example, incineration may destroy some TRI chemicals which would be otherwise put in landfills, but may also release chemical by-products to the air and produce ash that might then be disposed of in a landfill. Thus, the amounts of TRI chemicals released to off-site facilities do not directly indicate the amounts, or type of chemicals eventually released to the environment.

¹ Off-site transfers refer to chemical wastes transported off-site to commercial facilities that store, treat, or dispose of wastes. Off-site facilities might be owned by the reporting facility or its parent company, or they may be separate enterprises such as incinerators, privately-owned wastewater treatment facilities, landfills, or facilities which process and resell the chemicals, such as recycling facilities or waste brokers.

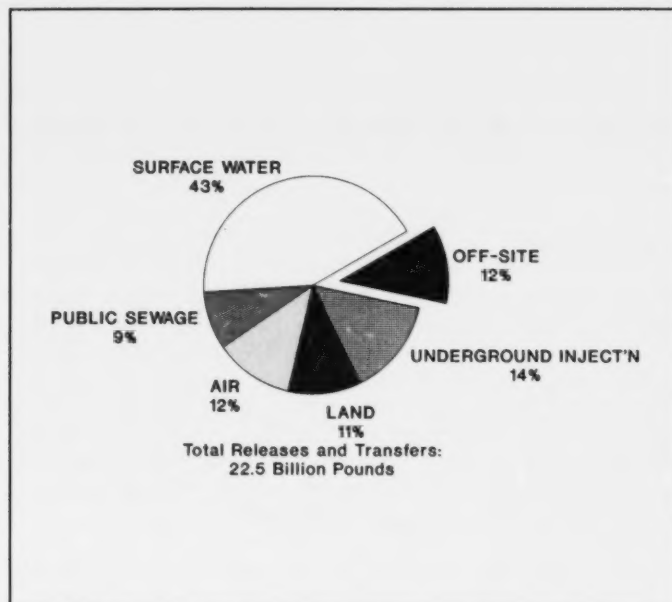


Figure 9-1.
Proportion of Total TRI Releases Transferred Off-Site, 1987

TRI required facilities to report the amount of TRI chemicals transferred off-site, as well as the locations to which they were transferred. This chapter describes the geographical distribution of transferring and receiving facilities, the industries that transferred large amounts of wastes, and the prominent TRI chemicals. A final section outlines the type of treatment that the TRI chemicals received at off-site facilities.

Geographical Distribution of Facilities that Transferred TRI Chemical Wastes

States

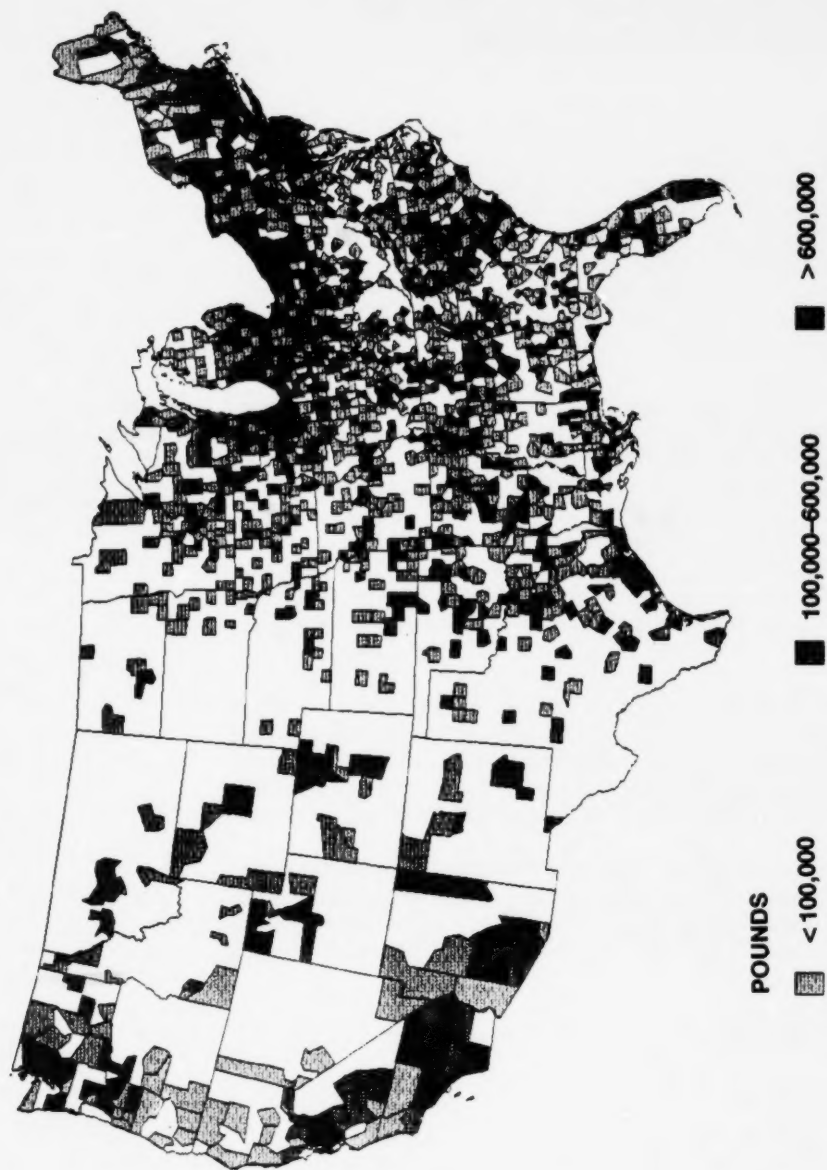
Facilities in three states—Michigan, Texas, and Ohio—together accounted for 40 percent of the total TRI off-site transfers (this includes all transfers originating in the state, whether destined for off-site facilities within the same state or in other states). Four additional states (Pennsylvania, Illinois, Indiana, and Louisiana) each reported transfers of over 100 million pounds of TRI chemical wastes off-site, accounting for an additional 19 percent of total transfers. Thus, facilities in seven states were responsible for 59 percent of all off-site transfers (Table 9-1).

Facilities in Michigan transferred 540 million pounds of TRI chemicals to off-site facilities (either in-state or out-of-state), which was the largest amount of TRI chemicals transferred off-site for any state, accounting for over one fifth of the total amount of TRI chemical wastes transferred (Map 9-1, Table 9-1). Michigan's off-site transfers were dominated by the transfer of metal compounds from a single facility in Ecorse, which were transferred to an off-site facility in the same city. Indeed, 75 percent of the state's total reported transfers of TRI chemicals wastes originated at this facility. (See the discussion below.)

Michigan, Texas, and Ohio accounted for 40 percent of all TRI off-site transfers.

Facilities in Texas reported the second largest amount of off-site transfers of TRI chemical wastes, 282 million pounds or 11 percent of total transfers—just half of the amount of off-site transfers reported in Michigan. Ohio facilities reported transfers totaling 232 million pounds, comprising another nine percent of total off-site transfers.

Facilities in Western states and New England, along with Alaska and Hawaii, reported the smallest amounts of off-site transfers. Of the nine jurisdictions with reported transfers of under 500,000 pounds each, five were in the West: Montana, Nevada, Idaho, and North and South Dakota.



Map 9-1. Total Off-Site Transfers of TRI Chemicals Reported Nationwide, by County, 1987

TABLE 9-1. TRI FACILITIES, FORMS AND AMOUNT OF OFF-SITE TRANSFERS BY STATE, 1987

TRI OFF-SITE TRANSFERS		FACILITIES REPORTING OFF-SITE TRANSFERS		FORMS REPORTING OFF-SITE TRANSFERS		AMOUNT OF TRI OFF-SITE TRANSFERS	
Rank	STATE	Number	Percent	Number	Percent	Pounds	Percent
13	Alabama	157	1.62	458	1.66	62,580,627	2.36
51	Alaska	1	0.01	4	0.01	139	0.00
52	American Samoa	0	0.00	0	0.00	0	0.00
39	Arizona	66	0.68	136	0.49	3,163,551	0.12
26	Arkansas	137	1.41	350	1.27	23,124,550	0.88
9	California	823	8.50	2,247	8.15	97,644,358	3.73
34	Colorado	85	0.88	202	0.73	5,321,533	0.20
24	Connecticut	248	2.56	712	2.58	23,677,774	0.90
38	Delaware	30	0.31	95	0.34	3,987,692	0.15
27	Florida	178	1.84	405	1.47	17,162,515	0.66
21	Georgia	281	2.90	678	2.46	32,555,326	1.24
50	Hawaii	5	0.05	19	0.07	30,226	0.00
47	Idaho	10	0.10	29	0.11	259,307	0.01
5	Illinois	598	6.17	1,653	5.99	111,556,134	4.28
6	Indiana	406	4.19	1,177	4.27	107,092,085	4.09
33	Iowa	116	1.20	293	1.06	6,149,084	0.23
16	Kansas	85	0.88	223	0.81	52,300,709	2.00
11	Kentucky	185	1.91	565	2.05	79,727,997	3.05
7	Louisiana	123	1.27	523	1.90	101,793,171	3.89
41	Maine	45	0.46	115	0.42	2,040,371	0.08
30	Maryland	91	0.94	316	1.15	11,035,136	0.42
20	Massachusetts	339	3.50	849	3.08	32,931,176	1.26
1	Michigan	460	4.75	1,580	5.73	539,530,650	20.61
29	Minnesota	113	1.17	309	1.12	11,833,822	0.45
14	Mississippi	110	1.14	251	0.91	54,106,141	2.07
18	Missouri	217	2.24	676	2.45	35,466,064	1.35
49	Montana	9	0.09	25	0.09	136,140	0.01
40	Nebraska	49	0.51	122	0.44	2,428,365	0.09
48	Nevada	7	0.07	15	0.05	141,555	0.01
32	New Hampshire	86	0.89	222	0.81	6,249,780	0.24
10	New Jersey	469	4.84	1,324	4.80	82,811,996	3.16
44	New Mexico	14	0.14	44	0.16	641,055	0.02
8	New York	404	4.17	1,169	4.24	97,670,612	3.73
17	North Carolina	359	3.71	889	3.22	44,990,734	1.72
46	North Dakota	10	0.10	14	0.05	279,990	0.01
3	Ohio	721	7.44	2,228	8.08	232,280,058	8.87
28	Oklahoma	88	0.91	203	0.74	16,196,697	0.62
31	Oregon	81	0.84	215	0.78	8,401,643	0.32
4	Pennsylvania	585	6.04	1,747	6.34	177,338,841	6.77
35	Puerto Rico	60	0.62	127	0.46	5,137,365	0.20
37	Rhode Island	89	0.92	187	0.68	4,439,825	0.17
15	South Carolina	212	2.19	606	2.20	52,886,551	2.02
45	South Dakota	17	0.18	27	0.10	452,952	0.02
23	Tennessee	234	2.42	582	2.11	28,631,687	1.09
2	Texas	471	4.86	1,734	6.29	281,688,463	10.76
36	Utah	49	0.51	132	0.48	4,762,932	0.18
42	Vermont	33	0.34	84	0.30	1,929,473	0.07
53	Virgin Islands	0	0.00	0	0.00	0	0.00
25	Virginia	185	1.91	502	1.82	23,590,468	0.90
19	Washington	133	1.37	356	1.29	33,588,830	1.28
22	West Virginia	60	0.62	231	0.84	29,174,069	1.11
12	Wisconsin	344	3.55	911	3.30	65,886,063	2.52
43	Wyoming	8	0.08	14	0.05	1,129,103	0.04
TOTAL		9,686	100.00	27,575	100.00	2,617,957,365	100.00
PERCENT OF ALL REPORTING		50.24		37.19		11.63	

Nearly three quarters of Michigan's total TRI releases and transfers were transferred off-site for treatment or disposal.

Off-site transfers from facilities in 25 counties accounted for half the total TRI off-site transfers.

Off-Site Transfers as a Proportion of State Total TRI Releases and Transfers

Off-site transfers comprised differing fractions of the total TRI releases and transfers for each state, ranging from nearly three quarters of the total reported releases and transfers in Michigan to under five percent of the total for 16 states (Table 9-1). (See also Chapter 5, Table 5-2.) The proportion of off-site transfers in Michigan is significantly higher than in any other state: 73 percent of the total TRI releases and transfers in Michigan were transferred off-site compared to 41 percent for Pennsylvania, which had the second largest proportion of off-site transfers.

Facilities in several other states in the Midwest and East transferred over 30 percent of their total TRI releases and transfers off-site: Vermont (40 percent); Wisconsin (36 percent); Ohio (32 percent); Kentucky (32 percent); Massachusetts (31 percent); and New York (30 percent). Except for Ohio none of these states ranked high for the total amount of TRI chemicals transferred off-site. Rather, off-site transfers comprised such a high percent of total TRI releases and transfers because they were the largest such category within each state.

Counties

Facilities in 25 counties accounted for over half of the total off-site transfers of TRI chemical wastes and often for substantial portions of the individual states' off-site transfers (Table 9-2). Map 9-1 shows how such off-site transfers were concentrated in particular counties. Facilities in Wayne County, Michigan—the county with the largest amount of off-site transfers—accounted for 18 percent (484 million pounds) of all off-site transfers of TRI chemical wastes (Table 9-2).

Other counties with large off-site transfers included Harris County, Texas (135 million pounds, 5 percent of all off-site transfers); Los Angeles County, California (48 million pounds, 2 percent of all off-site transfers); and Bucks County, Pennsylvania (48 million pounds, 2 percent of off-site transfers). Some counties accounted for a large portion of the TRI off-site transfers within a state, such as Wayne County, Michigan (90 percent of TRI off-site transfers in the state) and Los Angeles County, California (49 percent of all TRI off-site transfers in the state).

TABLE 9-2. THE 25 COUNTIES WITH THE LARGEST TRI
OFF-SITE TRANSFERS, 1987

COUNTY	STATE	TRI OFF-SITE TRANSFERS Pounds	PERCENT OF TRI OFF-SITE TRANSFERS IN THE STATE
WAYNE	MI	483,567,083	89.63
HARRIS	TX	135,307,397	48.03
LOS ANGELES	CA	48,082,390	49.24
BUCKS	PA	47,994,138	27.06
JEFFERSON	TX	43,138,979	15.31
COLBERT	AL	42,331,820	67.64
CUYAHOGA	OH	39,918,584	17.19
ST BERNARD	LA	37,605,062	36.94
LAMAR	MS	35,898,000	66.35
WARREN	NY	34,711,800	35.54
SEDGWICK	KS	33,244,227	63.56
COOK	IL	31,251,237	28.01
WOOD	WI	30,428,826	46.18
LAKE	IN	28,679,825	26.78
MIDDLESEX	NJ	27,803,452	33.57
CHARLESTON	SC	26,422,827	49.96
UNION	NJ	25,730,567	31.07
BOYD	KY	23,583,046	29.58
NUECES	TX	22,688,764	8.05
GRAYS HARBOR	WA	22,566,000	67.18
ASHTABULA	OH	22,532,559	9.70
MOREHOUSE	LA	22,409,500	22.01
MADISON	IL	20,252,479	18.15
HAYWOOD	NC	19,640,926	43.66
STARK	OH	19,092,475	8.22
SUBTOTAL		1,324,881,963	
PERCENT OF GRAND TOTAL		50.61	
TOTAL FOR ALL OTHERS		1,293,075,402	
GRAND TOTAL		2,617,957,365	

Geographical Distribution of Facilities Receiving Off-site Transfers

States

Figure 9-2 shows the states receiving the largest amounts of TRI off-site transfers *from within the same state*. Michigan, Texas, Ohio, and Pennsylvania had the largest intra-state transfers.

Over one quarter of reported off-site transfers were sent out-of-state. Ohio Facilities received 13 percent of the total amount of TRI chemicals transported across state lines.

In contrast, Figure 9-3 details the states receiving the largest quantities of transfers *from out of state*. In 1987, over one-quarter of all reported off-site transfers of TRI chemical wastes (731 million pounds) were transported to facilities across state lines.² Ohio facilities received nearly 13 percent of all out-of-state transfers (92 million pounds), the largest share for any state; wastes transferred to Ohio facilities accounted for nine percent of the total off-site transfers of TRI chemical wastes. Louisiana, Indiana, New Jersey, Pennsylvania, and Michigan also received large amounts of off-site transfers from out-of-state facilities, each accepting over 40 million pounds of off-site transfers. Western states and New England states received the smallest amounts of chemicals transported from out-of-state.

Cities Receiving Largest Off-Site Transfers

Facilities in Ecorse, Michigan received 397 million pounds of TRI off-site transfers—15 percent of the total transferred in 1987.

The city in Michigan which accounted for that state's high rank is Ecorse (Table 9-3). It alone received transfers of 397 million pounds of TRI chemical wastes, equalling 15 percent of all reported TRI off-site transfers, and almost four times the amount received by any other city. Other cities receiving large amounts of off-site transfers of TRI chemical wastes included Deer Park, Texas (112 million pounds, four percent of all off-site transfers) and Baton Rouge, Louisiana (87 million pounds, three percent of all off-site transfers). The ten cities receiving the largest amounts of off-site transfers accounted for 32 percent of all off-site transfers.

2 Because transfer sites were not identified for over 94 million pounds (four percent) of off-site transfers, it cannot be determined whether these wastes were transported out of state.

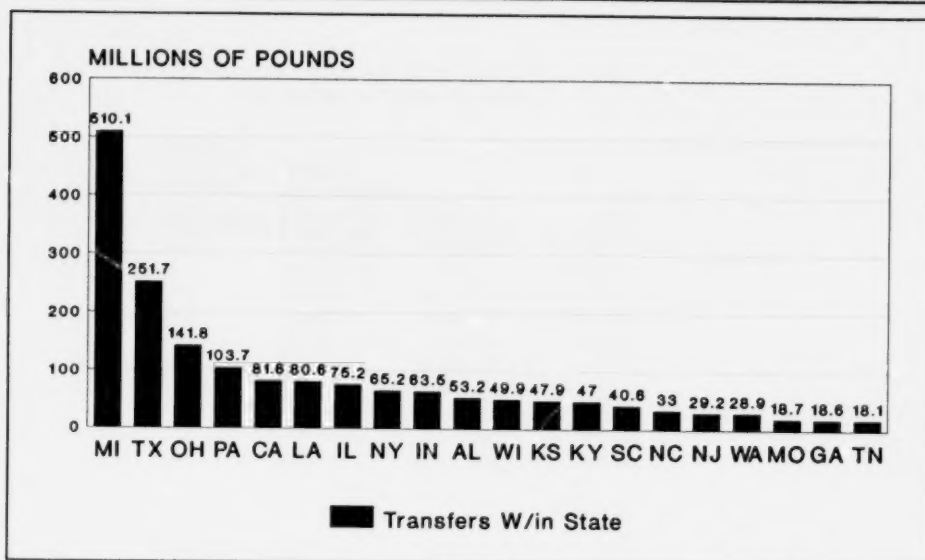


Figure 9-2.

The 20 States Receiving the Largest Off-site Transfers of TRI Chemicals from in-state Facilities, 1987. (Off-site transfers originating and remaining in-state.)

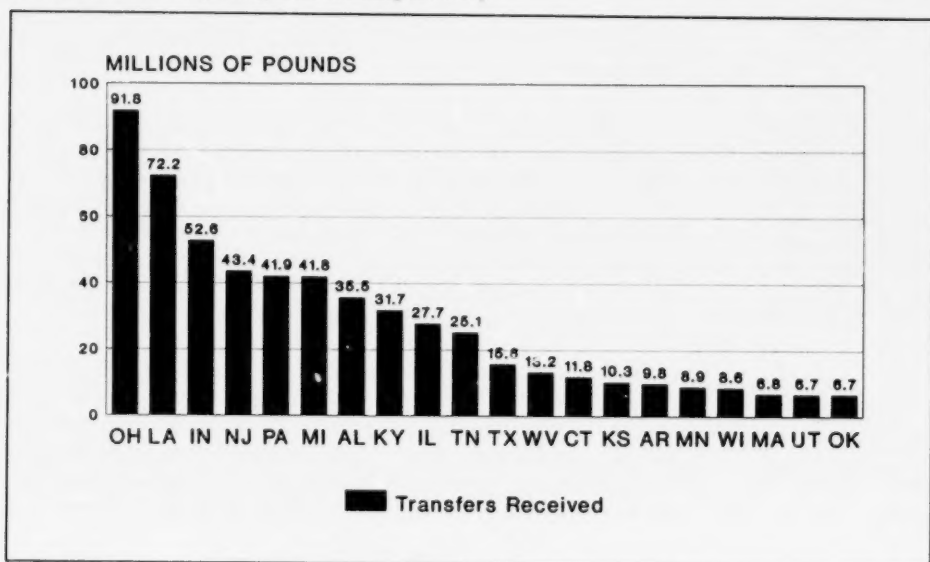


Figure 9-3.

The 20 States Receiving the Largest Off-site Transfers of TRI Chemicals from Out-of-State Facilities, 1987. (Off-site transfers generated in one state, transferred to another.)

TABLE 9-3. THE TEN CITIES WITH THE LARGEST AMOUNT OF TRI OFF-SITE TRANSFERS, 1987

CITY	STATE	AMOUNT TRANSFERRED TO THE CITY	PERCENT OF TOTAL OFF-SITE TRANSFERS
Ecorse	Michigan	396,580,500	15.15
Deer Park	Texas	111,802,869	4.27
Baton Rouge	Louisiana	87,247,936	3.33
Belleville	Michigan	44,514,531	1.70
Leighton	Alabama	42,129,100	1.61
Detroit	Michigan	39,342,280	1.50
Glens Falls	New York	33,792,500	1.29
Cleveland	Ohio	33,702,290	1.29
Wichita	Kansas	31,691,406	1.21
Emelle	Alabama	26,440,690	1.01
SUBTOTAL		847,244,102	32.36
TOTAL FOR ALL OTHERS		1,770,713,263	67.64
GRAND TOTAL OF TRI OFF-SITE TRANSFERS		2,617,957,365	100.00

Types of Treatment or Disposal for Off-site Transfers

Nearly one third of all TRI off-site transfers were disposed of in landfills or by other means, 22 percent went to treatment facilities, and 6 percent were recovered or reused.

The largest portion of off-site transfers of TRI chemical wastes went to facilities that disposed of the chemicals on land. (On-site land disposal is described in Chapter 8). Landfills and surface impoundments received the largest amounts of off-site transfers—666 million pounds or 25 percent of the off-site transfer wastes (Table 9-4).³ Another four percent (95 million pounds) of off-site transfers were injected into underground wells. Less than one percent (17 million pounds) went to land treatment and to other land disposal.

A significant fraction of TRI chemical wastes transferred off-site went to some type of waste treatment facility. (Waste treatment is described in detail in Chapter 10.) Ten percent of all off-site transfers (256 million pounds) were sent to wastewater treatment facilities other than public sewage systems. Five percent (140 million pounds) of TRI chemical wastes were transferred to off-site facilities that incinerate

³ The TRI form did not call for reporting off-site transfers to landfills and to surface impoundments separately, as it did for on-site land releases, so the data do not indicate whether surface impoundments dominate here as well.

or treat wastes thermally. Six percent (169 million pounds) went to facilities that reuse wastes as fuel or recover metals and organics (however, because off-site recycling of wastes was exempt from TRI reporting, the actual extent of fuel reuse and metals recovery may be under-represented).

Nearly seven percent of all off-site transfers of TRI chemical wastes, (177 million pounds), went to "other off-site management" facilities or facilities where the treatment or method practiced by the facilities that received these wastes were not identified (or unknown). Less than one percent (18 million pounds) of all off-site transfers of TRI chemical wastes were transferred to storage facilities. The remaining one third of reported off-site transfers (901 million pounds) went to facilities where they were subjected to multiple treatment or disposal methods.

TABLE 9-4. NUMBER OF TRI FORMS AND AMOUNT OF TRANSFERS TO OFF-SITE LOCATIONS BY TYPE OF OFF-SITE TREATMENT/DISPOSAL, 1987

TYPE OF TREATMENT/DISPOSAL	TRI FORMS WITH OFF-SITE TRANSFERS		TRI OFF-SITE TRANSFERS	
	Number	Percent	Pounds	Percent
LANDFILL OR OTHER DISPOSAL	8,102	29.36	778,537,032	29.74
LANDFILL/SURFACE IMPOUNDMENT	7,436	26.97	666,258,631	25.45
UNDERGROUND INJECTION	311	1.13	95,361,767	3.64
OTHER LAND DISPOSAL	355	1.29	18,916,634	0.65
STORAGE	306	1.11	18,223,263	0.70
TREATMENT	8,164	29.61	574,108,929	21.93
WASTEWATER TREATMENT (PRIVATE)	1,074	3.89	256,284,005	9.79
OTHER TREATMENT	1,722	6.24	141,100,790	5.30
INCINERATION/THERMAL TREATMENT	4,539	16.46	140,136,267	5.35
SOLIDIFICATION/STABILIZATION	654	2.37	26,854,116	1.03
LAND TREATMENT	175	0.63	9,733,741	0.37
REUSE OR RECOVERY	3,789	13.74	188,916,265	6.45
REUSE AS FUEL/FUEL BLENDING	2,776	10.07	101,382,633	3.87
TRANSFER TO WASTE BROKER	861	3.12	48,182,306	1.80
METALS RECOVERY	13	0.05	10,665,116	0.41
ORGANICS RECOVERY	117	0.42	5,045,911	0.19
OTHER RECOVERY	22	0.08	2,640,299	0.10
NOT SPECIFIC OR UNKNOWN	2,465	8.94	178,884,466	6.76
OTHER OFF-SITE MANAGEMENT	530	1.92	134,213,968	5.13
NOT A VALID CODE	985	3.57	23,093,012	0.88
OFF-SITE MANAGEMENT UNKNOWN	950	3.45	19,577,486	0.75
MULTIPLE TREATMENT/DISPOSAL	4,749	17.22	901,287,410	34.43
TOTAL	27,575	100.00	2,817,957,365	100.00

Note: If a submitter entered an on-site treatment code rather than off-site treatment code, the transfer amount was included in the appropriate category.

Industries that Transferred TRI Chemical Wastes to Off-site Facilities

Industrial Distribution

The Primary Metals industry transferred the largest amount of TRI chemicals to off-site facilities.

Facilities in the Primary Metals industry transferred 961 million pounds of TRI chemical wastes to off-site facilities, which accounted for the largest share (37 percent) of TRI transfers to off-site facilities (Figure 9-4, Table 9-5). Facilities in the Chemical and Allied Products industry ranked second for off-site transfers, transporting 720 million pounds, or 28 percent of the total. These two industries also ranked second and first, respectively, for total releases and transfers of all types (see Chapter 5).

Other industries reporting more than 100 million pounds of transfers of TRI chemical wastes to off-site facilities included Petroleum Refining and Related industries with 206 million pounds (eight percent), Paper and Allied Products with 129 million pounds (five percent), and

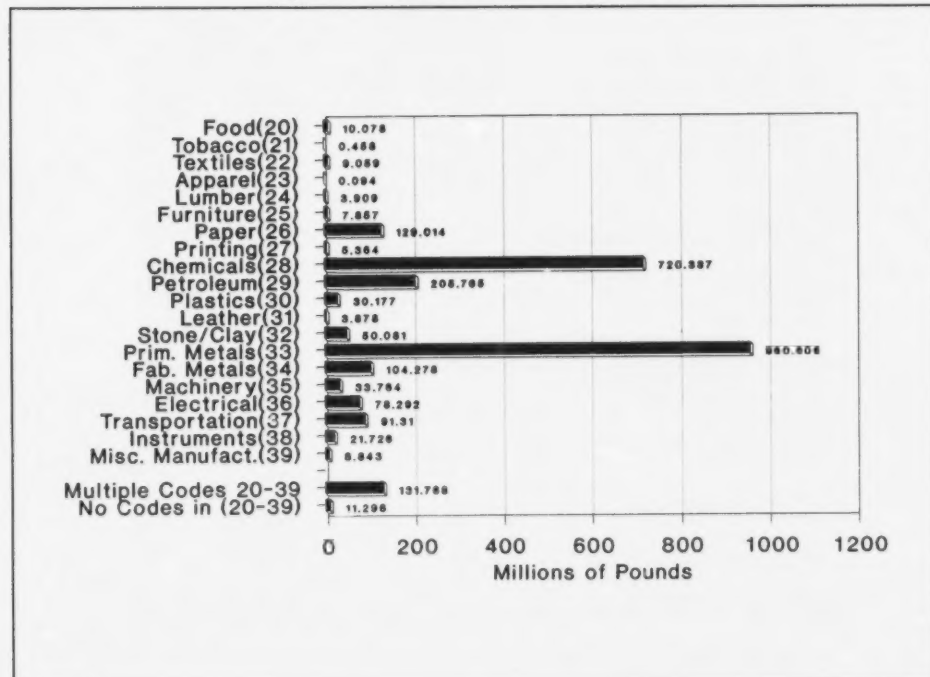


Figure 9-4.
Off-Site Transfers Of TRI Chemicals By Industry, 1987. By Standard Industrial Classification (SIC) Codes.

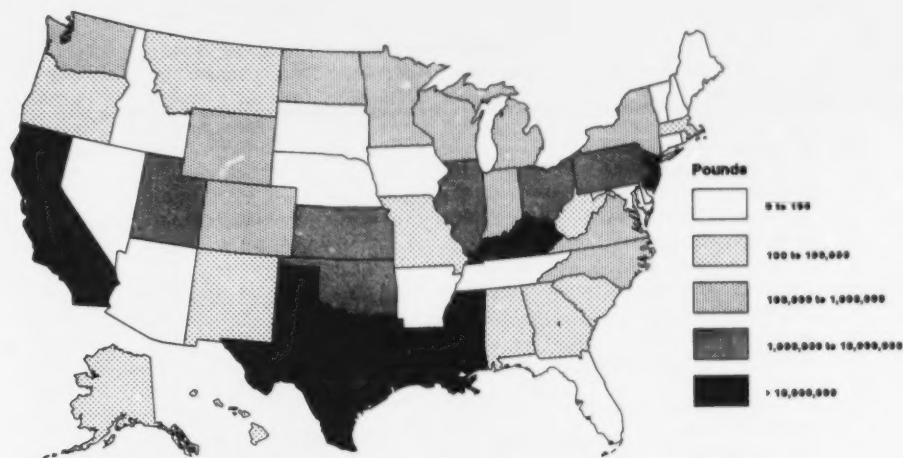
Off-site Transfers of Chemical Wastes

TABLE 9-5. TRI FACILITIES, FORMS AND AMOUNT OF OFF-SITE TRANSFERS BY INDUSTRY, 1987

TRI OFF-SITE TRANSFER	SIC	INDUSTRY	FACILITIES REPORTING OFF-SITE TRANSFERS		FORMS REPORTING OFF-SITE TRANSFERS		AMOUNT OF TRI OFF-SITE TRANSFERS	
			Number	Percent	Number	Percent	Pounds	Percent
	Rank	CODE						
	14	20 Food Products	130	1.34	220	0.80	10,077,922	0.38
	21	21 Tobacco Manufacturers	6	0.06	9	0.03	458,196	0.02
	15	22 Textile Mill Products	125	1.29	262	0.95	9,058,955	0.35
	22	23 Apparel	7	0.07	11	0.04	94,221	0.00
	19	24 Lumber and Wood Products	280	2.89	788	2.86	3,909,453	0.15
	17	25 Furniture and Fixtures	178	1.84	591	2.14	7,857,362	0.30
	5	26 Paper Products	295	3.05	727	2.64	129,014,310	4.93
	18	27 Printing, Publishing	167	1.72	325	1.18	5,364,131	0.20
	2	28 Chemical Products	1,903	19.65	7,680	27.85	720,337,123	27.52
	3	29 Petroleum Refining	165	1.70	872	3.16	205,764,651	7.86
	11	30 Rubber and Plastic Products	598	6.17	1,241	4.50	30,177,303	1.15
	20	31 Leather Products	63	0.65	137	0.50	3,878,288	0.15
	9	32 Stone, Clay, Glass Products	294	3.04	569	2.06	50,081,467	1.91
	1	33 Primary Metals	689	7.11	2,008	7.28	960,608,352	36.69
	6	34 Fabricated Metals	1,385	14.30	3,147	11.41	104,277,700	3.98
	10	35 Machinery, except Electrical	465	4.80	1,027	3.72	33,764,108	1.29
	8	36 Electric and Electronic Equip.	935	9.65	2,249	8.16	78,291,668	2.99
	7	37 Transportation Equipment	620	6.40	2,262	8.20	91,310,180	3.49
	12	38 Measuring, Photographic Goods	203	2.10	483	1.75	21,725,976	0.83
	16	39 Misc. Manufacturing	167	1.72	416	1.51	8,842,508	0.34
	4	Multiple SIC codes in 20 - 39	895	9.24	2,210	8.01	131,767,953	5.03
	13	No SIC codes in 20 - 39	116	1.20	341	1.24	11,295,538	0.43
		TOTAL	9,686	100.00	27,575	100.00	2,617,957,365	100.00
		PERCENT OF ALL REPORTING		50.24		37.19		11.63

Fabricated Metal Products with 104 million pounds (4 percent). Three other industries – Transportation Equipment, Electrical and Electronic Equipment, and Stone, Clay, and Glass Products – transferred more than 50 million pounds each.

Off-site transfers by the Petroleum Refining industry are illustrated in Map 9-2. The largest off-site transfers by the industry occurred in the Gulf Coast states of Texas, Louisiana, and Mississippi, followed by East and West Coast states (New Jersey and California) and Kentucky.



Map 9-2.
TRI Chemicals Transported Off-Site by the Petroleum Refining Industry, 1987.

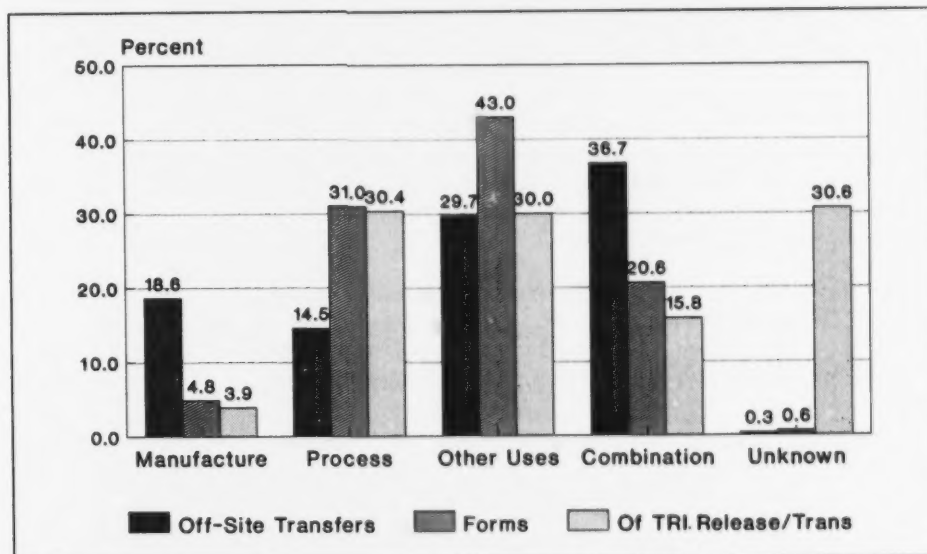


Figure 9-5.
Off-Site Transfers Of TRI Chemicals By Industrial Activities And Uses, 1987.

Industrial Activities and Uses

One-fifth of all off-site transfers of TRI chemical wastes (488 million pounds) were from facilities engaged in *manufacture only* activities (Figure 9-5). These facilities submitted only five percent of all chemical-specific forms (1,334 forms) reporting off-site transfers. These off-site transfers accounted for only four percent of all releases and transfers from facilities engaged in *manufacture only* activities, indicating that most wastes from these facilities are treated and disposed of on-site (or released to air or water) rather than transferred off-site.

A larger portion of wastes are transported off-site for treatment or disposal by facilities engaged in *process only* or *other uses only* than by facilities engaged in *manufacture only*. Facilities using chemicals in only *other uses* submitted 43 percent of the forms reporting off-site transfers (11,849 forms) and accounted for 30 percent of all off-site transfers (779 million pounds). Only 15 percent of off-site transfers (380 million pounds) were from facilities that indicated *process only*, yet the off-site transfers from these facilities accounted for 30 percent of all releases from these facilities. These facilities submitted 31 percent of all forms (8,548 forms) reporting off-site transfers.

Facilities identifying *combined uses* accounted for 37 percent of all off-site transfers (962 million pounds), representing 16 percent of all releases from these facilities. These facilities submitted 21 percent of all forms (5,680 forms) reporting off-site transfers.

Facilities and Companies that Transfer and Receive TRI Chemical Wastes

Facilities Transferring Chemicals Off-Site

Some facilities that received off-site transfers are independently owned and operated, while others are owned by a facility or parent company from which they receive a portion, or all, of the wastes accepted. Three-quarters of the facilities that reported off-site transfers of TRI chemical wastes transferred their wastes to off-site facilities or disposal sites that they did not own or control (Table 9-6). These transfers amounted to 1.7 billion pounds of TRI chemicals, comprising 65 percent of all TRI off-site transfers.

Only three percent of the facilities that reported off-site transfers sent all of their wastes to locations owned or controlled by themselves or their parent companies; these transfers made up six percent (157 million pounds) of all reported off-site transfers. Another 12 percent of such facilities, representing 687 million pounds or 26 percent of the

A larger portion of wastes were transported off-site for treatment or disposal by facilities engaged in "process-ing" or "other uses only" than engaged in "manufacturing only."

Three-quarters of the facilities reporting off-site transfers of TRI chemicals transported their wastes to off-site facilities they did not own or control.

TABLE 9-6. NUMBER OF TRI FACILITIES REPORTING WHETHER OR NOT OFF-SITE TRANSFER LOCATION IS UNDER CONTROL OF FACILITY OR PARENT COMPANY

UNDER CONTROL	TRI FACILITIES		AMOUNT OF TRANSFERS	
	Number	Percent	Pounds	Percent
YES	305	3.15	156,754,143	5.99
NO	7,424	76.65	1,708,414,877	65.26
COMBINATION	1,116	11.52	686,608,346	26.23
BLANK	841	8.68	66,179,999	2.53
TOTAL	9,686	100.00	2,617,957,365	100.00

total amount of off-site transfers, reported sending some portion of their transfers to facility- or corporate-owned sites and sending the remainder to independent off-site facilities.

Largest Off-Site Transfers

Off-site transfers of 340 million pounds of aluminum oxide from a single facility⁴ in Ecorse, Michigan dominated all other individual off-site transfers. This transfer alone comprised 13 percent of the total amount of off-site transfers of TRI chemical wastes for the nation in 1987. The second largest transfer in 1987, 55 million pounds of manganese compounds (two percent of all off-site transfers), was transferred off-site by the same facility. Taken together, these two transfers comprised 15 percent of the total amount of TRI chemical wastes transferred off-site, and 73 percent of all reported off-site transfers in Michigan. They were also the reason why this city received the largest amount of off-site transfers of any city in the nation (see Table 9-3, above).

No other off-site transfers from a single facility were greater than 50 million pounds (or more than two percent of the total off-site transfers). The next three largest transfers, ranging from 35 to 44 million pounds, consisted of chemicals in the acids/bases/salts class (see below and Chapter 4 for an explanation of chemical classes). These three transfers were made from facilities in Pennsylvania, Louisiana, and Mississippi. Taken together, the five largest transfers of individual TRI chemical wastes comprised almost one-fifth of the total amount of chemicals transferred off-site (509 million pounds) in 1987.

4 The Great Lakes Division of the National Steel Corporation.

The largest individual off-site transfer was 340 million pounds of aluminum oxide in Ecorse, Michigan.

Receiving Facilities Regulated under RCRA.

Many TRI chemicals are also regulated under the Resource Conservation and Recovery Act (RCRA). Facilities that transfer or receive chemical wastes covered by RCRA must have a RCRA identification number (described in Chapter 3). Facilities that reported off-site transfers listed a RCRA identification number for the receiving facility in 85 percent of the chemical forms they submitted. The remaining 15 percent of the forms might represent off-site transfers to municipal landfills or other sites not regulated under RCRA, or they might represent sites for which the reporting facility did not know the correct RCRA identification number.

Many chemicals covered by TRI are also regulated under RCRA; 85 percent of forms reporting off-site transfers listed a RCRA ID number.

TRI Chemicals Transferred Off-site

TRI facilities transferred more aluminum oxide off-site than any other TRI chemical (Table 9-7). Aluminum oxide comprised one third of all off-site transfers of TRI chemical wastes, a total of 862 million pounds. A single facility with a transfer of 340 million pounds of aluminum oxide in 1987, located in Ecorse, Michigan (described above) accounted for 39 percent of the total reported aluminum oxide transfers.

Aluminum oxide accounted for one third of off-site transfers.

Four other chemicals were transferred in amounts greater than 100 million pounds, each representing between four and nine percent of the total off-site transfers of TRI chemical wastes: sulfuric acid (231 million pounds); sodium hydroxide (135 million pounds); sodium sulfate (131 million pounds); and hydrochloric acid (107 million pounds). Five additional chemicals transferred in amounts over 50 million pounds included toluene, xylene, methanol, manganese compounds, and zinc compounds. Taken together, these ten chemicals accounted for 70 percent of the total amount of TRI chemical wastes transferred off-site. The top 25 chemicals made up 87 percent of all off-site transfers of TRI chemical wastes.

Of the 272 chemicals for which TRI releases and transfers were reported, 242 were transported in some amount off-site for treatment or disposal, while 30 (11 percent) were not transported off-site (Table 9-8).

Metals and metal compounds represented nearly half of all off-site transfers.

Chemical Classes

Facilities transported larger amounts of metals and metal compounds off-site than any other chemical class (Figure 9-6, Table 9-9). While metals and metal compounds represented only 15 percent of the total TRI releases and transfers, they constituted nearly half (1.2 billion pounds) of the total amounts of chemicals transported off-site.

The acids/bases/salts class ranked second for total off-site transfers. This class represented one-quarter of all off-site transfers, whereas it made up 69 percent of total TRI releases and transfers. Organics comprised approximately 19 percent of the off-site transfers, followed by halo-organics (five percent), non-metallic inorganics (one percent), and mixtures (one percent).

TABLE 9-7. NUMBER OF TRI FORMS AND AMOUNT OF TRANSFERS FOR THE 25 CHEMICALS WITH THE LARGEST OFF-SITE TRANSFERS, 1987

Rank	CHEMICAL NAME	TRI FORMS REPORTING OFF-SITE TRANSFERS		AMOUNT OF TRI OFF-SITE TRANSFERS	
		Number	Percent	Pounds	Percent
2	ALUMINUM OXIDE	784	2.84	861,591,039	32.91
5	SULFURIC ACID	783	2.84	230,515,099	8.81
6	SODIUM HYDROXIDE (SOLUTION)	1,124	4.08	135,071,893	5.16
1	SODIUM SULFATE (SOLUTION)	256	0.93	130,606,774	4.99
4	HYDROCHLORIC ACID	438	1.59	107,387,120	4.10
9	TOLUENE	1,809	6.56	79,259,364	3.03
12	XYLENE (MIXED ISOMERS)	1,546	5.61	74,612,447	2.85
8	METHANOL	846	3.08	71,802,772	2.74
21	MANGANESE COMPOUNDS	152	0.55	66,692,040	2.55
16	ZINC COMPOUNDS	731	2.65	60,512,500	2.31
13	METHYL ETHYL KETONE	1,304	4.73	46,085,612	1.76
23	ZINC (FUME OR DUST)	312	1.13	40,574,726	1.55
11	ACETONE	1,054	3.82	37,614,073	1.44
15	COPPER	692	2.51	35,926,437	1.37
34	TOTAL FOR MIXTURES	230	0.83	33,415,914	1.28
17	DICHLOROMETHANE	706	2.56	31,225,718	1.19
37	ALUMINUM (FUME OR DUST)	127	0.46	30,972,767	1.18
14	1,1,1-TRICHLOROETHANE	1,474	5.35	29,998,240	1.15
29	LEAD	340	1.23	28,553,775	1.09
42	NAPHTHALENE	143	0.52	28,313,419	1.08
27	STYRENE	305	1.11	26,403,615	1.01
22	NITRIC ACID	333	1.21	25,287,175	0.97
38	MANGANESE	276	1.00	23,530,841	0.90
41	CHROMIUM	505	1.83	21,780,874	0.83
50	ASBESTOS (FRIABLE)	95	0.34	19,872,387	0.76
	SUBTOTAL	16,367	59.35	2,277,606,621	87.00
	TOTAL FOR ALL OTHERS	11,208	40.65	340,350,744	13.00
	GRAND TOTAL	27,575	100.00	2,617,957,365	100.00

TABLE 9-8. CHEMICALS FOR WHICH NO TRI OFF-SITE TRANSFERS WERE REPORTED, 198
(Of the 272 chemicals for which some releases were reported)

1	1,3-DICHLOROPROPYLENE	16	CHLOROMETHYL METHYL ETHER
2	2,4,6-TRICHLOROPHENOL	17	ETHYL CHLOROFORMATE
3	2,4-DIAMINOANISOLE	18	HYDRAZINE SULFATE
4	2,4-DIAMINOTOLUENE	19	METHOXYCHLOR
5	2,6-XYLIDINE	20	NITROGEN MUSTARD
6	4,4'-DIAMINODIPHENYL ETHER	21	N-NITROSODIPHENYLAMINE
7	4,4'-METHYLENEBIS(N,N-DIMETHYL)	22	PERACETIC ACID
8	4-AMINOAZOBENZENE	23	POLY BROMINATED BIPHENYLS
9	4-AMINOBIPHENYL	24	PROPANE SULFONE
10	5-NITRO-O-ANISIDINE	25	PROPYLENEIMINE
11	ACROLEIN	26	P-ANISIDINE
12	BIS(CHLOROMETHYL) ETHER	27	SAFROLE
13	CALCIUM CYANAMIDE	28	STYRENE OXIDE
14	CARBONYL SULFIDE	29	THALLIUM COMPOUNDS
15	CHLOROBENZILATE	30	VINYL BROMIDE

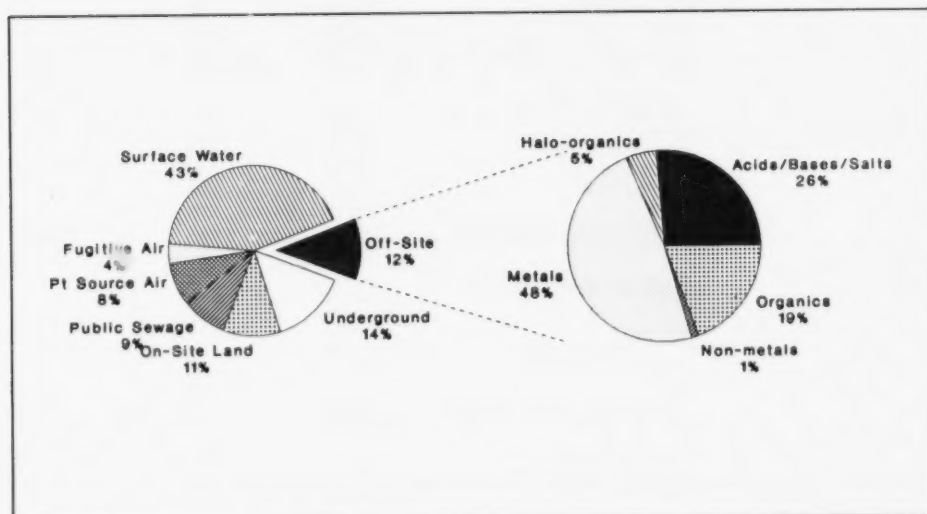


Figure 9-6.
Off-Site Transfers By Chemical Class, Compared To Total TRI Releases, 1987. Total off-site transfers: 2.6 billion pounds. Mixtures accounted for 1.3 percent of the total; Trade Secrets for less than 0.5 percent.

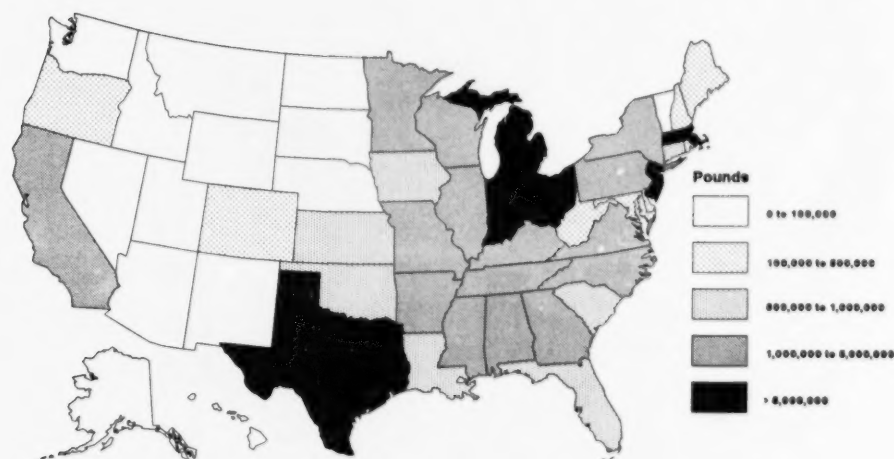
TABLE 9-9. TRI OFF-SITE TRANSFERS BY CHEMICAL CLASS, 1987

TOTAL TRI RELEASE/ TRANSFER Rank	CHEMICAL NAME	TRI OFF-SITE TRANSFERS Pounds	PERCENT OF TOTAL TRI OFF-SITE TRANSFERS
Acids/Bases/Salts			
1	SODIUM SULFATE (SOLUTION)	130,806,774	4.99
3	AMMONIUM SULFATE (SOLUTION)	13,419,977	0.51
4	HYDROCHLORIC ACID	107,367,120	4.10
5	SULFURIC ACID	230,515,099	8.61
6	SODIUM HYDROXIDE (SOLUTION)	135,071,893	5.16
10	PHOSPHORIC ACID	10,778,338	0.41
	Subtotal	627,779,201	23.96
	TOTAL FOR ALL OTHERS IN CLASS	48,093,804	1.84
	TOTAL FOR CLASS	675,873,005	25.82
Halo-organics			
14	1,1,1-TRICHLOROETHANE	29,998,240	1.15
17	DICHLOROMETHANE	31,225,718	1.19
25	FREON 113	9,090,684	0.35
26	TRICHLOROETHYLENE	10,320,188	0.39
35	TETRACHLOROETHYLENE	8,518,855	0.33
	Subtotal	89,153,685	3.41
	TOTAL FOR ALL OTHERS IN CLASS	40,882,031	1.56
	TOTAL FOR CLASS	130,035,716	4.97
Metals and Metal Compounds			
2	ALUMINUM OXIDE	861,591,039	32.91
15	COPPER	35,926,437	1.37
18	ZINC COMPOUNDS	60,512,500	2.31
21	MANGANESE COMPOUNDS	66,692,040	2.55
23	ZINC (FUME OR DUST)	40,574,726	1.55
	Subtotal	1,065,296,742	40.69
	TOTAL FOR ALL OTHERS IN CLASS	181,504,145	6.93
	TOTAL FOR CLASS	1,246,800,887	47.62
Non-metallic Inorganics			
7	AMMONIA	5,413,883	0.21
19	CHLORINE	1,743,642	0.07
49	ARSENIC COMPOUNDS	1,978,288	0.08
50	ASBESTOS (FRIABLE)	19,872,387	0.76
57	CHLORINE DIOXIDE	28,990	0.00
	Subtotal	29,037,190	1.11
	TOTAL FOR ALL OTHERS IN CLASS	3,654,571	0.14
	TOTAL FOR CLASS	32,691,761	1.25
Organics (non-halogenated)			
8	METHANOL	71,802,772	2.74
9	TOLUENE	79,259,364	3.03
11	ACETONE	37,614,073	1.44
12	XYLENE (MIXED ISOMERS)	74,612,447	2.85
13	METHYL ETHYL KETONE	46,085,612	1.78
	Subtotal	309,374,268	11.82
	TOTAL FOR ALL OTHERS IN CLASS	189,137,607	7.22
	TOTAL FOR CLASS	498,511,875	19.04
34	TOTAL FOR MIXTURES	33,415,914	1.28
100	TOTAL FOR TRADE SECRETS	628,207	0.02
	GRAND TOTAL	2,817,957,365	100.00

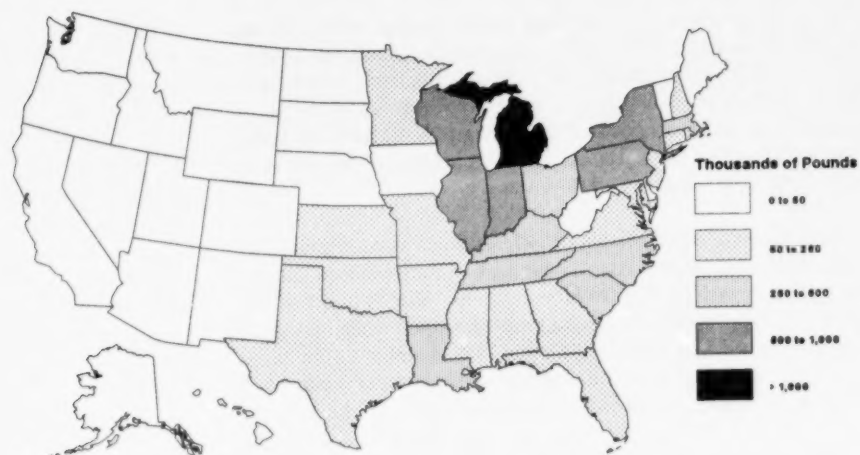
Selected Chemicals

Maps 9-3 through 9-9 illustrate the geographical distribution of toluene, trichloroethylene, aluminum oxide, methyl ethyl ketone, xylene (mixed isomers), dichloromethane, and the metals/metal compounds class. Off-site transfers of toluene and trichloroethylene (Maps 9-3 and 9-4) were distributed similarly to the total TRI releases and transfers for these chemicals (Maps 5-3 and 5-4): facilities in the Midwest and South reported the largest amounts for off-site transfers as well as TRI total releases and transfers.

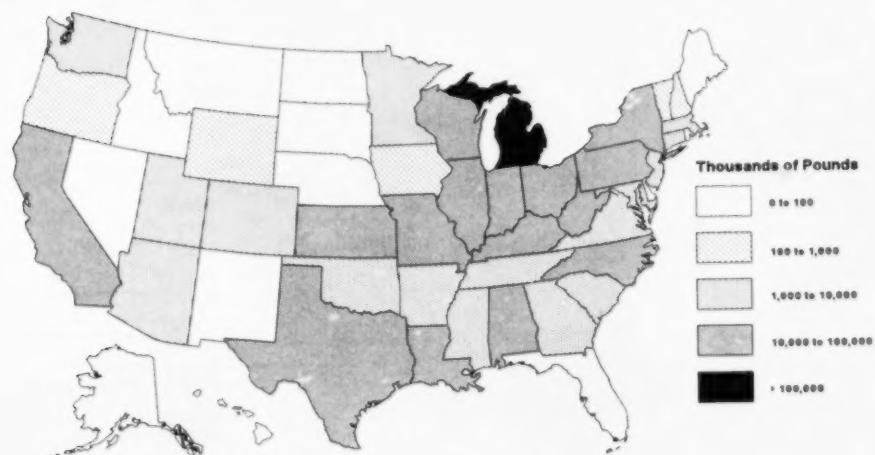
In contrast, Tennessee and Michigan had the largest total releases and transfers of toluene, while Texas, Michigan, Indiana and Ohio had the largest off-site transfers. For trichloroethylene, Illinois and Indiana had the largest reported total releases and transfers, while Michigan had the largest off-site transfers. Other TRI chemicals with large reported amounts of off-site transfers had similar overall patterns of distribution, with highest off-site transfers in states in the Eastern United States, Texas, and California; however, transfers for specific states varied. For example, Michigan was the state with the largest transfers of aluminum oxide, while dichloromethane and metals had a high percentage of off-site transfers in West Virginia and Washington. Different patterns can be seen for other states.



Map 9-3.
Off-Site Transfers of Toluene Reported to TRI, 1987.



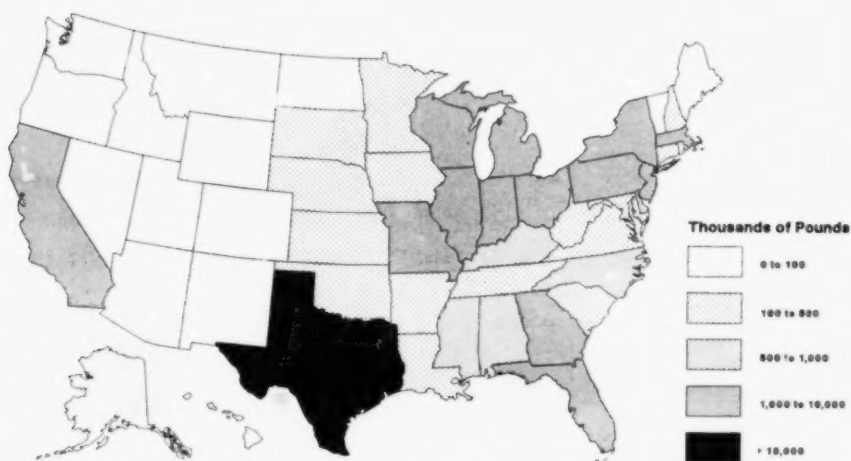
Map 9-4.
Off-Site Transfers Of Trichloroethylene Reported to TRI, 1987.



Map 9-5.
Off-Site Transfers of Aluminum Oxide Reported to TRI, 1987.



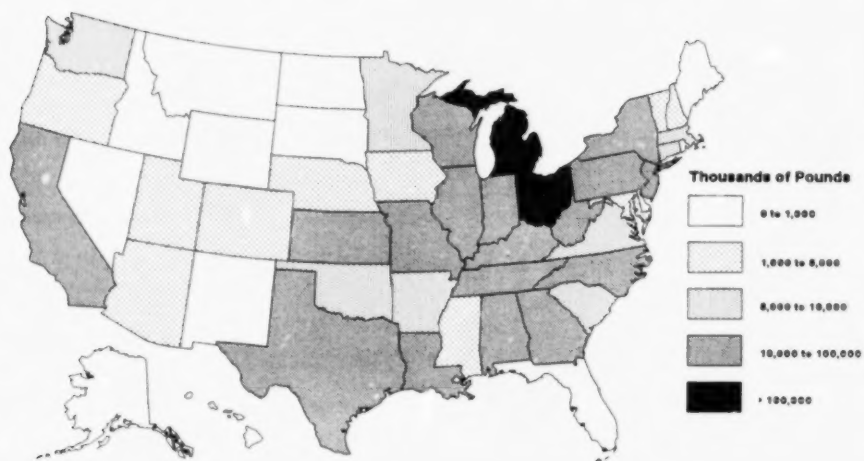
Map 9-6.
Off-Site Transfers of Methyl Ethyl Ketone Reported to TRI, 1987.



Map 9-7.
Off-Site Transfers of Xylene (Mixed Isomers) Reported to TRI, 1987.



Map 9-8.
Off-Site Transfers of Dichloromethane Reported to TRI, 1987.



Map 9-9.
Off-Site Transfers of Metals and Metal Compounds Reported to TRI, 1987.

Basis of Estimate for Off-site Transfers

Thirty-six percent of all off-site transfer amounts of TRI chemical wastes reported were measured amounts (Figure 9-7)—the highest percentage for any type of release. An additional 16 percent of off-site transfers were calculated, less than one percent were estimated by emission factors, and 20 percent were estimated by other methods. The methods used to arrive at 26 percent of reported off-site transfer amounts are unknown.

Thirty-six percent of off-site transfers were measured amounts.

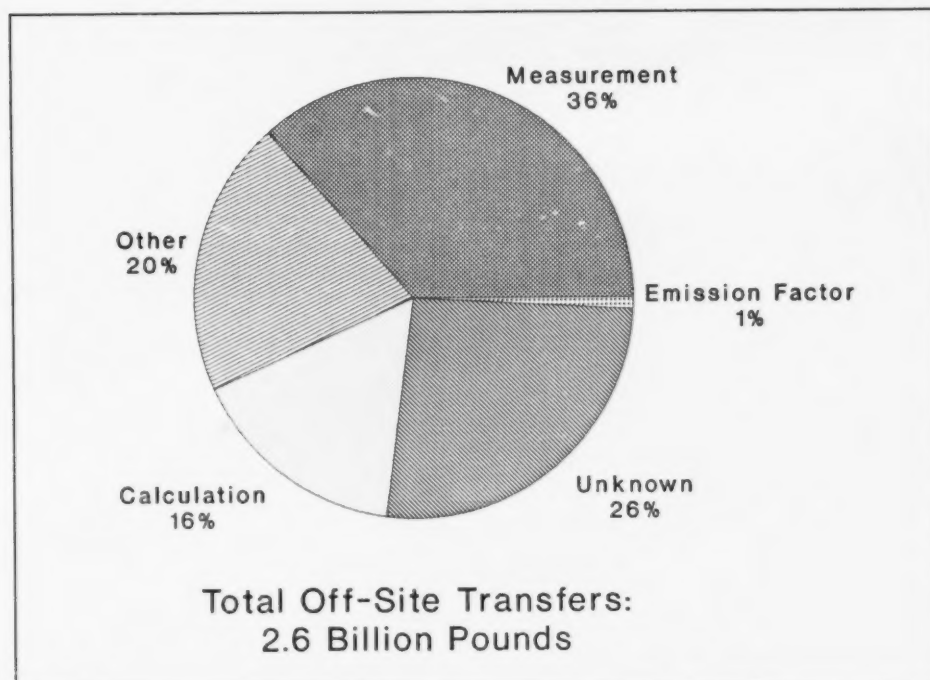
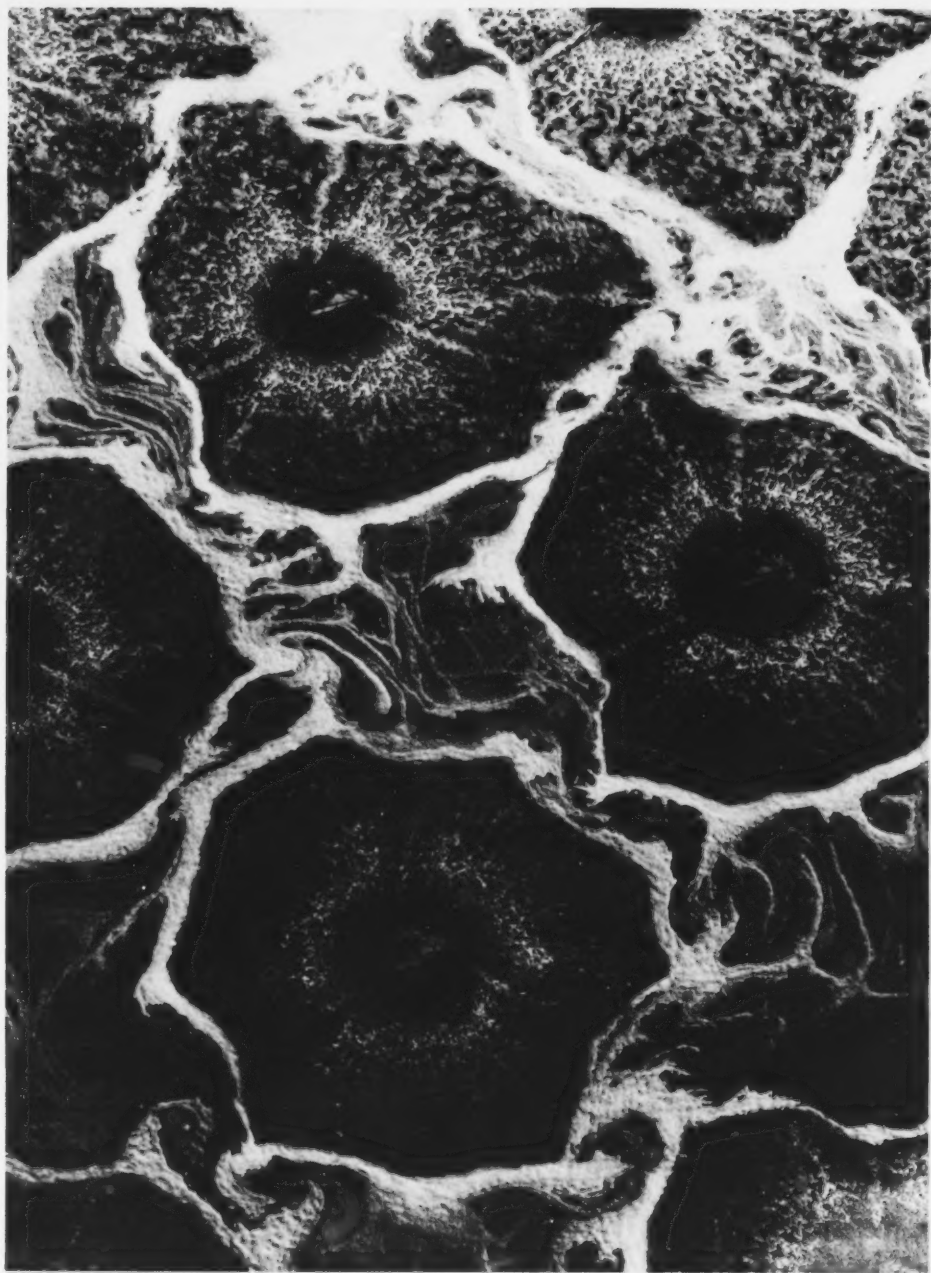


Figure 9-7.
Methods For Assessing Off-Site Transfer Amounts Reported To TRI, 1987

Issues in Interpreting Off-site Transfer Data

When toxic chemicals are released directly to the environment, as were those examined in Chapters 6 through 8, it is possible to identify the geographical location and the segment of the environment (air, water, or land) into which these chemicals were initially discharged.⁵ In contrast, off-site transfers are not necessarily released directly. As noted above, chemicals transported to off-site locations may be stored or disposed of after little or no treatment, or they may be subjected to various degrees and methods of treatment that reduce the amounts, or transform the wastes, which are ultimately released to air, water, or land. TRI forms indicate the amounts initially transported off-site, but the forms do **not** reveal the final amounts and types of release for the off-site transfers. Off-site transfer amounts described in this chapter should be interpreted with this distinction in mind.

⁵ Of course, even direct releases to one part of the environment might end up elsewhere: chemicals discharged into water, for example, may evaporate into the air; chemicals deposited on land may leach into groundwater and be transported to nearby surface waters.



Chapter 10. Waste Treatment

Introduction

Previous chapters have described releases and transfers of Toxics Release Inventory (TRI) chemicals to the environment. Many TRI chemical wastes, however, are treated before they are released to the environment. Waste treatment can reduce, or even prevent, chemical releases to the environment. Thus, TRI requested that facilities report their waste treatment methods, the chemicals in the treated wastes, and the efficiency of their treatment methods.

Just over one half of the facilities that filed TRI reports (9,725 out of a total of 19,278) indicated that they treated chemical wastes on-site before releasing or transferring the wastes. These facilities submitted 32,482 TRI forms, almost one half of the total forms submitted (Figure 10-1). Six percent of all TRI forms reported treating wastes but not releasing them. On the other hand, eight percent of all TRI forms indicated neither treatment nor release.

This chapter discusses the geographical and industrial distribution of facilities that treated TRI chemical wastes on-site, and describes the chemicals and types of wastestreams that were treated. The chapter also summarizes the waste treatment methods used and their efficiencies.¹

Over half of all TRI facilities reported treating chemical wastes on-site before release.

¹ Note that TRI waste treatment data—unlike release and transfer data—were not reported in pounds. Rather, treatment data provides information on the percent efficiency and the type of treatment. Hence, analyses in this chapter are fundamentally different than those presented elsewhere in this report.

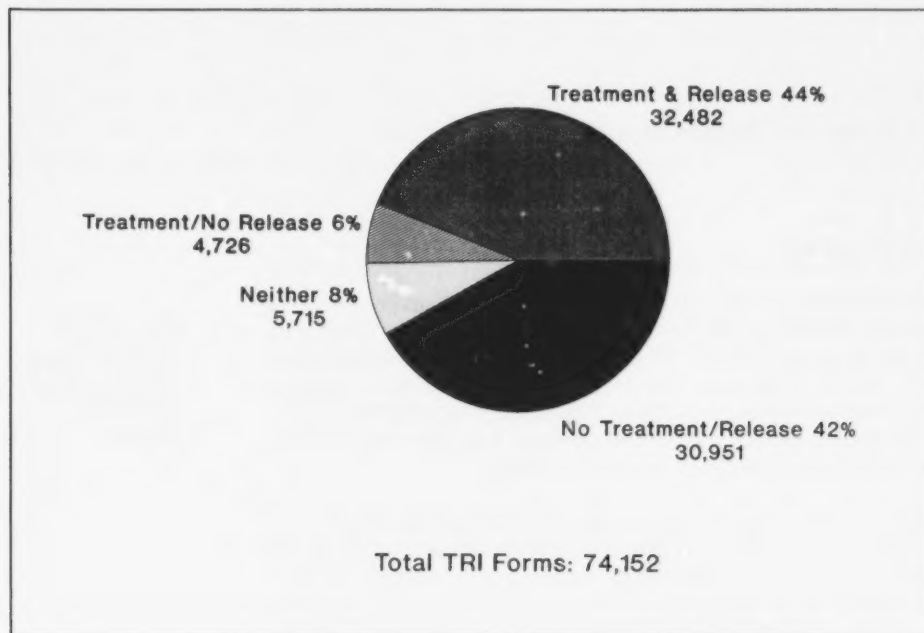


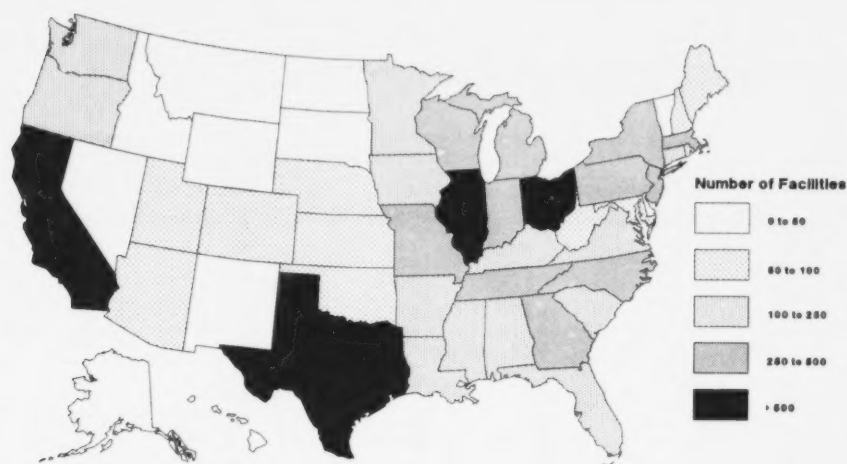
Figure 10-1.
TRI Forms Reporting Waste Treatment and Releases to the Environment, 1987.

Geographical Distribution

The states with the most facilities reporting on-site treatment of TRI chemical wastes were California, Texas, and the Midwest (Map 10-1). The states with the fewest facilities with on-site treatment were primarily in the West.

The number of facilities in each state that use waste treatment depends, in part, on the total number of facilities located in the state. Thus, a more telling statistic is the percentage of TRI facilities which treat their wastes on-site. The ratio of facilities within each state that reported on-site waste treatment generally ranged from 40 to 60 percent (Table 10-1). In seven states, the ratio was greater than 60 percent, but several of these states had such small total numbers of facilities that the ratio may be skewed. In four states, the ratio was less than 40 percent – ranging from 20 percent to 30 percent. Once again, these were states with a small total number of facilities.

In most states, 40 to 60 percent of TRI facilities reported on-site waste treatment.



Map 10-1.
TRI Forms Reporting Waste Treatment, 1987.

Among the states that had the most TRI facilities, Michigan, which ranked ninth for total number of facilities, had the highest ratio of TRI facilities reporting waste treatment – 56 percent. In California, which had the most TRI facilities, 54 percent of the facilities indicated using on-site waste treatment, while New York (eighth for TRI total facilities) had 52 percent.

Industrial Patterns of Waste Treatment

The Chemical and Allied Products industry had the most facilities reporting on-site treatment of TRI chemical wastes (2,049 out of a total of 3,849 that reported TRI data), followed by the Fabricated Metals industry (1,430 out of 2,393 facilities) (Figure 10-2, Table 10-2).

The percentage of facilities reporting on-site waste treatment of TRI chemical wastes for each industry ranged from 29 to 61 percent. The Chemical and Allied Products industry, ranked seventh for percentage of facilities that used waste treatment, while the Fabricated Metals industry ranked fourth at just under 60 percent. The Electrical and Electronic Equipment industry had the highest percentage of facilities reporting waste treatment (61 percent), followed by the Paper and

The Chemical industry had the most facilities reporting on-site waste treatment, while the Electrical and Electronic Equipment industry had the highest proportion of facilities doing so.

TABLE 10-1. NUMBER OF TRI FACILITIES REPORTING ON-SITE WASTE TREATMENT BY STATE, 1987

NO. OF FACILITIES REPORTING WASTE TREATMENT	STATE	TRI FACILITIES REPORTING WASTE TREATMENT Number	TRI FACILITIES REPORTING IN THE STATE Number	PERCENT OF TRI TOTAL IN THE STATE THAT REPORTED WASTE TREATMENT	RANK FOR PROPORTION OF FACILITIES REPORTING WASTE TREATMENT
21	Alabama	173	355	48.73	34
51	Alaska	6	7	85.71	2
53	American Samoa	0	2	0.00	53
29	Arizona	97	156	62.18	6
26	Arkansas	119	293	40.61	48
1	California	895	1,662	53.85	18
34	Colorado	78	172	45.35	43
17	Connecticut	222	383	57.96	11
41	Delaware	34	53	64.15	4
18	Florida	205	419	48.93	33
13	Georgia	278	636	43.71	44
48	Hawaii	10	33	30.30	50
42	Idaho	29	52	55.77	15
3	Illinois	602	1,185	50.80	26
9	Indiana	360	720	50.00	29
25	Iowa	147	310	47.42	38
30	Kansas	96	184	52.17	22
23	Kentucky	163	298	54.70	16
22	Louisiana	168	259	64.09	5
40	Maine	51	83	61.45	8
31	Maryland	90	191	47.12	39
12	Massachusetts	298	560	53.21	20
6	Michigan	423	758	55.80	14
24	Minnesota	152	301	50.50	27
27	Mississippi	119	247	48.18	35
15	Missouri	262	503	52.09	24
46	Montana	16	27	59.26	10
35	Nebraska	70	139	50.36	28
44	Nevada	23	33	69.70	3
36	New Hampshire	69	129	53.49	19
7	New Jersey	406	875	46.40	42
45	New Mexico	19	32	59.38	9
8	New York	397	765	51.90	25
10	North Carolina	351	820	42.80	46
50	North Dakota	8	28	28.57	51
2	Ohio	621	1,261	49.25	31
32	Oklahoma	80	193	41.45	47
28	Oregon	101	217	46.54	40
5	Pennsylvania	492	1,027	47.91	37
33	Puerto Rico	80	172	46.51	41
38	Rhode Island	60	166	36.14	49
16	South Carolina	244	394	61.93	7
49	South Dakota	10	37	27.03	52
14	Tennessee	263	503	52.29	21
4	Texas	521	999	52.15	23
39	Utah	55	102	53.92	17
43	Vermont	26	52	50.00	30
52	Virgin Islands	1	1	100.00	1
19	Virginia	173	399	43.36	45
20	Washington	173	306	56.54	13
37	West Virginia	62	107	57.94	12
11	Wisconsin	316	645	48.99	32
47	Wyoming	13	27	48.15	36
	TOTAL	9,725	19,278	50.45	

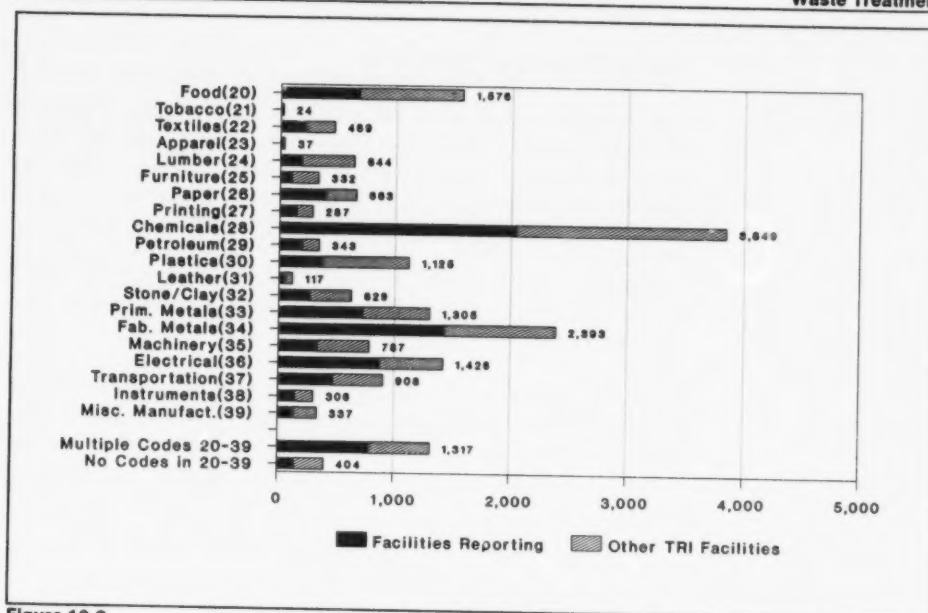


Figure 10-2.
TRI Facilities Reporting Waste Treatment by Industry, 1987.

Paper Products industry and the multiple industry category, each with 60 percent.

The Tobacco Manufacturers, Apparel, and Leather Products industries had the fewest facilities reporting on-site treatment of TRI chemical wastes, with 9, 13, and 44 facilities, respectively. The Lumber and Wood Products and the Furniture and Fixtures industries had the lowest percent of facilities reporting waste treatment, each with 29 percent.

Waste Treatment Methods

TRI required that facilities indicate their on-site waste treatment methods from the following list of seven broad categories: air emissions treatment, biological treatment, chemical treatment, incineration/thermal treatment, physical treatment, recovery/reuse, and solidification/stabilization (Box 10-A). Facilities could list more than one treatment method; a **combination** of independent treatment operations applied to wastes of one TRI chemical at the facility were distinguished from **sequential** treatment operations applied to one wastestream.

Sequential treatment denotes several types of treatment done in sequence on the same wastestream. For example, a wastewater stream might be treated in a settling tank (physical treatment), then by

Waste Treatment Methods

TRI requested information from TRI facilities about the use of seven general methods for treating wastes.

Air Emissions: treatment of air emissions to filter out, trap, or burn chemicals from the air stream before release to the environment.

Biological: treatment that uses microorganisms to remove organic pollutants from wastewater.

Chemical: treatment with other chemicals or chemical processes to change toxic chemicals into less harmful chemicals or to make them less soluble and easier to remove. The primary types of chemical treatments are precipitation, neutralization, and oxidation.

Incineration/Thermal: treatment by controlled burning at high temperature to destroy wastes.

Physical: treatment by physical means to remove chemicals from the wastestream, e.g. filtering settling, adsorption to resin or carbon, air stripping, emulsion breaking.

Recovery/Reuse: treatment to remove chemicals from the wastestream for reuse as fuel or solvent, or recovery of metals for reuse.

Solidification/Stabilization: treatment to remove wastewater from a waste or to change it chemically to make the waste less permeable and susceptible to transport water. Examples are cement processes, asphaltic processes, and thermoplastic techniques.

Box 10-A.

precipitation (chemical treatment), and finally by aerobic digestion (biological treatment). Because TRI reports are chemical specific, facilities could also list multiple but independent treatments. For example, a facility might have released a chemical in both air and liquid wastestreams, treating the air wastestream with a scrubber (air emissions treatment) and the liquid wastestream by precipitation (chemical treatment). Alternatively, a facility might have released a chemical in only one wastestream, but reported on several independent treatments that were used in different parts of the facility or at different times over the course of the year for that one wastestream. Finally, facilities reported on the efficiency of their waste treatment — either for a single method or for the total efficiency of sequential treatment.

TABLE 10-2. NUMBER OF TRI FACILITIES REPORTING ON-SITE WASTE TREATMENT BY INDUSTRY, 1987

SIC CODE	INDUSTRY	TRI FACILITIES REPORTING WASTE TREATMENT Number	TRI FACILITIES IN THE INDUSTRY Number	PERCENT OF FACILITIES IN THE INDUSTRY REPORTING WASTE TREATMENT
20	Food Products	678	1,576	43.02
21	Tobacco Manufacturers	9	24	37.50
22	Textile Mill Products	217	469	46.27
23	Apparel	13	37	35.14
24	Lumber and Wood Products	189	644	29.35
25	Furniture and Fixtures	98	332	29.52
26	Paper Products	399	663	60.18
27	Printing, Publishing	144	287	50.17
28	Chemical Products	2,048	3,849	53.21
29	Petroleum Refining	201	343	58.60
30	Rubber and Plastic Products	373	1,125	33.16
31	Leather Products	44	117	37.61
32	Stone, Clay, Glass Products	267	629	42.45
33	Primary Metals	724	1,305	55.48
34	Fabricated Metals	1,430	2,393	59.76
35	Machinery, except Electrical	334	787	42.44
36	Electric and Electronic Equip.	875	1,426	61.36
37	Transportation Equipment	469	908	51.65
38	Measuring, Photographic Goods	145	306	47.39
39	Misc. Manufacturing	134	337	39.76
	Multiple SIC codes in 20 - 39	790	1,317	59.98
	No SIC codes in 20 - 39	144	404	35.64
	TOTAL	9,725	19,278	50.45

TABLE 10-3. NUMBER OF TRI FACILITIES AND FORMS REPORTING BY ON-SITE WASTE TREATMENT METHOD, 1987

	TRI FACILITIES		TRI FORMS	
	Number	Percent	Number	Percent
AIR EMISSIONS	931	9.57	4,419	11.88
BIOLOGICAL	235	2.42	1,430	3.84
CHEMICAL	2,048	21.06	8,859	23.81
INCINERATION	283	2.91	1,359	3.65
PHYSICAL	454	4.67	1,989	5.35
RECOVERY/REUSE	556	5.72	1,647	4.43
SOLIDIFICATION	42	0.43	134	0.36
COMBINATION	3,194	32.34	7,249	19.48
SEQUENTIAL	831	8.54	6,233	16.75
UNKNOWN	1,151	11.84	3,889	10.45
TOTAL	9,725	100.00	37,208	100.00

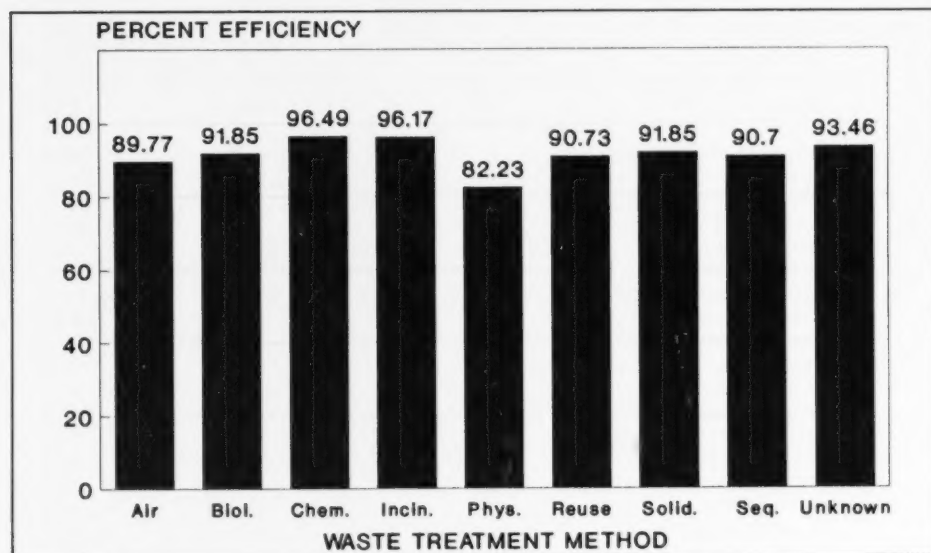


Figure 10-3. Average Treatment Efficiency for Each Treatment Method Reported to TRI, 1987.

The largest fraction of facilities (33 percent) reported using a combination of treatment methods (but not sequential treatment methods) (Table 10-3). Sequential treatment was reported by almost nine percent of the facilities listing on-site waste treatment.

One third of TRI facilities reporting waste treatment used a combination of methods to treat their TRI chemical wastes.

The individual method used by the most facilities was chemical treatment, reported by 21 percent of the facilities on 24 percent of the forms listing on-site waste treatment. Air emissions treatment ranked second, with ten percent of the facilities reporting air treatment methods on 12 percent of the forms. Recovery/reuse was reported by six percent of the facilities treating their TRI chemical wastes, physical treatment by five percent, incineration by three percent, biological treatment by two percent, and solidification/stabilization by less than one percent.

Efficiency of Waste Treatment Methods

Facilities were required to report the waste treatment efficiency—the percentage of the TRI chemical that was removed from the wastestream. The average treatment efficiency ranged from 82 to 96 percent for treatment methods reported with a treatment efficiency greater than zero (Figure 10-3).² Chemical treatment and incineration had the highest average reported efficiencies, with 96 percent. Physical treatment methods and air emissions treatments had the lowest average efficiencies, with 82 and 90 percent respectively.

Average waste treatment efficiencies ranged from 82 to 96 percent.

² Facilities were required to report each treatment method used on a wastestream containing a TRI chemical, regardless of whether the treatment method actually removed that specific chemical. Thus, forms may have indicated a "zero" treatment efficiency if the treatment method was not intended to remove that specific chemical, or if treatment lessened the availability or mobility of a chemical (e.g. through solidification) without reducing the quantity. Also, for wastestreams with sequential treatment, facilities were allowed to estimate the treatment efficiency for the overall treatment process; this estimate was listed on the TRI form only in connection with the last step in the treatment process and not for any intermediate steps. Thus, the efficiency of intermediate treatment methods would have been left blank and would appear in the TRI database as zero.

Basis For Estimated Treatment Efficiency

Only 39 percent of treatment efficiency estimates were based on actual operating data.

Most treatment efficiency percentages reported to TRI were based on estimates and not on actual measurements. Facilities indicated that only 39 percent of the treatment efficiency estimates were based on actual operating data, such as monitoring of wastes going into and coming out of treatment. The proportion of efficiency estimates based on operating data varied according to the method of treatment, ranging from 16 percent for efficiency estimates for air emissions treatment to 61 percent for efficiency estimates for chemical treatment (Figure 10-4). Those efficiency estimates not based on operating data were based on information from flow rate, equipment supplier's literature, published data for similar processes, or other means.

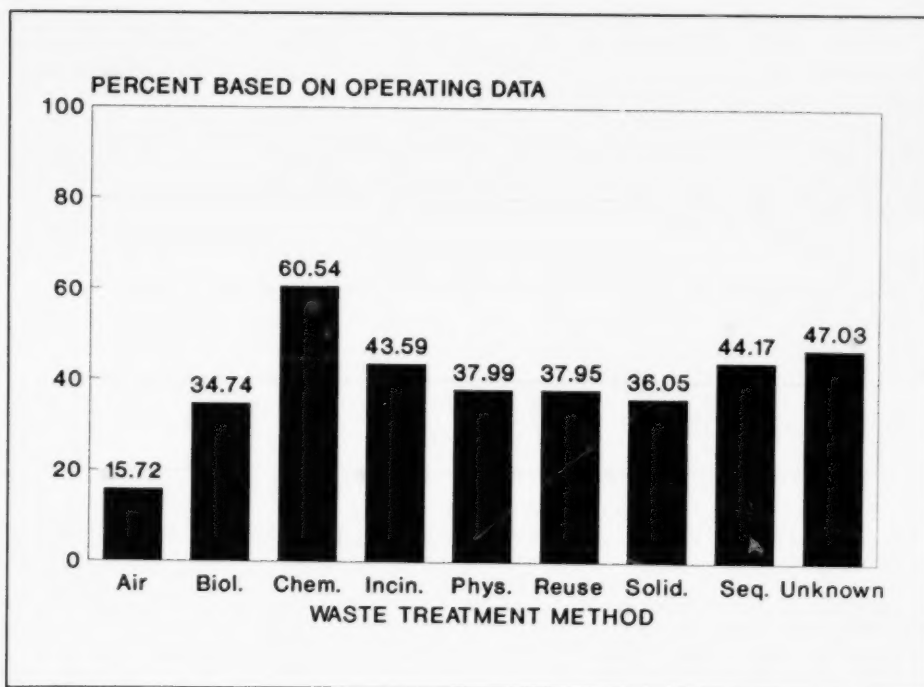


Figure 10-4.
Basis for Average Efficiency Estimate, 1987.

Types of Wastestreams Treated

For each waste treatment method reported, facilities were required to report which one of the four following types of wastestream was treated: **air or gaseous** (including gases, vapors and airborne particulates), **wastewater** (aqueous waste), **liquid** (non-aqueous waste), or **solid** (including sludges and slurries). Approximately 32 percent of the facilities (3,107) treating TRI chemical wastes on-site treated wastewater only (Figure 10-5). Fifteen percent of the facilities reported treating gaseous wastes only, seven percent treated liquids only, and three percent treated solid wastes only. Many facilities (41 percent) treated wastes in more than one type of wastestream.

One third of TRI facilities treated wastewater only, 15 percent gaseous wastes, 7 percent liquids, and 3 percent solid wastes, and 41 percent a combination of wastestreams.

The average efficiency for treatment of TRI chemical wastes was similar for all types of wastestreams, ranging from 89 percent for solid wastes to 95 percent for liquid wastes (Figure 10-6). Gaseous wastes and wastewater were treated with average efficiencies of 94 percent each.

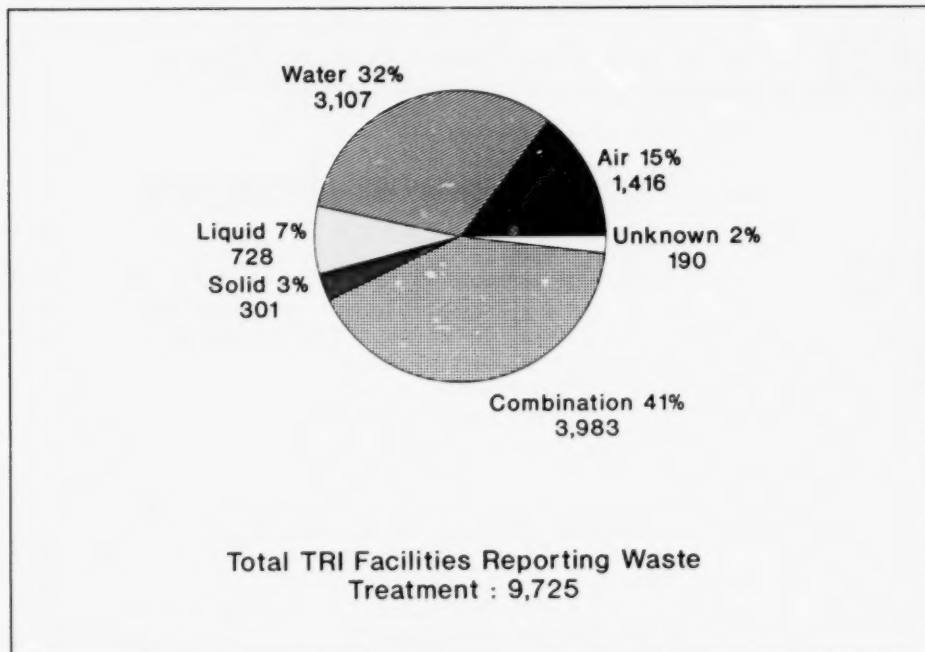


Figure 10-5.
TRI Facilities Reporting Waste Treatment by Type of Wastestream, 1987.

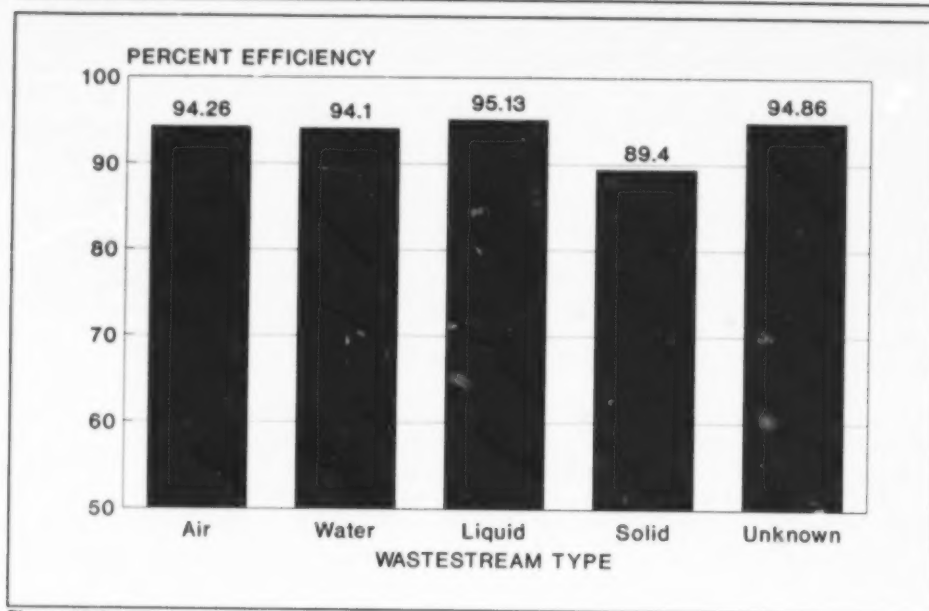


Figure 10-6.
Average Treatment Efficiency by Wastestream Type Reported to TRI, 1987.

Chemicals Subjected to Waste Treatment

Individual Chemicals

On-site waste treatment was reported for 262 (96 percent) of the 272 TRI chemicals for which TRI forms were received. Table 10-4 lists the 25 TRI chemicals that were reported as treated on-site on the most number of forms. Over 380 forms reporting on-site waste treatment were submitted for each of these 25 chemicals, accounting for a total of 25,850 forms, or 69 percent of all forms reporting on-site waste treatment.

The ratio of the number of forms reporting on-site waste treatment for individual TRI chemicals, to the total number of TRI forms submitted for the chemical, varies for individual TRI chemicals. For example, 80 percent of the TRI forms submitted on hydrogen fluoride reported on-site treatment of wastes containing this chemical (383 out of 480 forms). However, only 25 percent of the forms submitted on 1,1,1-trichloroethane reported on-site treatment of wastes containing this chemical (764 out of 3,084 forms).

Twenty-five chemicals accounted for 69 percent of all forms reporting on-site waste treatment.

TABLE 10-4. THE 25 TRI CHEMICALS WITH THE MOST FACILITIES REPORTING ON-SITE TREATMENT, 1987

CHEMICAL NAME	TRI FORMS WITH WASTE TREATMENT Number	PERCENT OF ALL TRI FORMS FOR THE CHEMICAL THE CHEMICAL	TOTAL TRI FORMS FOR THE CHEMICAL Number
SODIUM HYDROXIDE (SOLUTION)	4,290	62.51	6,815
SULFURIC ACID	3,502	70.83	4,944
HYDROCHLORIC ACID	2,201	75.77	2,905
NITRIC ACID	1,331	78.85	1,688
PHOSPHORIC ACID	1,273	62.18	2,048
TOLUENE	1,177	37.08	3,174
AMMONIA	1,084	44.77	2,421
XYLENE (MIXED ISOMERS)	996	36.07	2,781
METHANOL	919	44.98	2,043
CHLORINE	850	48.91	1,736
ACETONE	778	37.24	2,089
1,1,1-TRICHLOROETHANE	764	24.77	3,084
SODIUM SULFATE (SOLUTION)	745	53.18	1,401
METHYL ETHYL KETONE	685	32.59	2,102
ZINC COMPOUNDS	653	59.20	1,103
ALUMINUM OXIDE	633	48.58	1,303
COPPER	622	47.12	1,320
ETHYLENE GLYCOL	478	40.10	1,192
CHROMIUM COMPOUNDS	452	53.36	847
DICHLOROMETHANE	426	30.15	1,413
GLYCOL ETHERS	423	40.87	1,035
CHROMIUM	422	51.03	827
NICKEL	407	54.12	752
FORMALDEHYDE	386	51.74	746
HYDROGEN FLUORIDE	383	79.79	480
SUBTOTAL	25,850	51.46	50,231
PERCENT OF GRAND TOTAL	89		88
TOTAL FOR ALL OTHERS	11,358	47.48	23,921
GRAND TOTAL	37,208	50.18	74,152

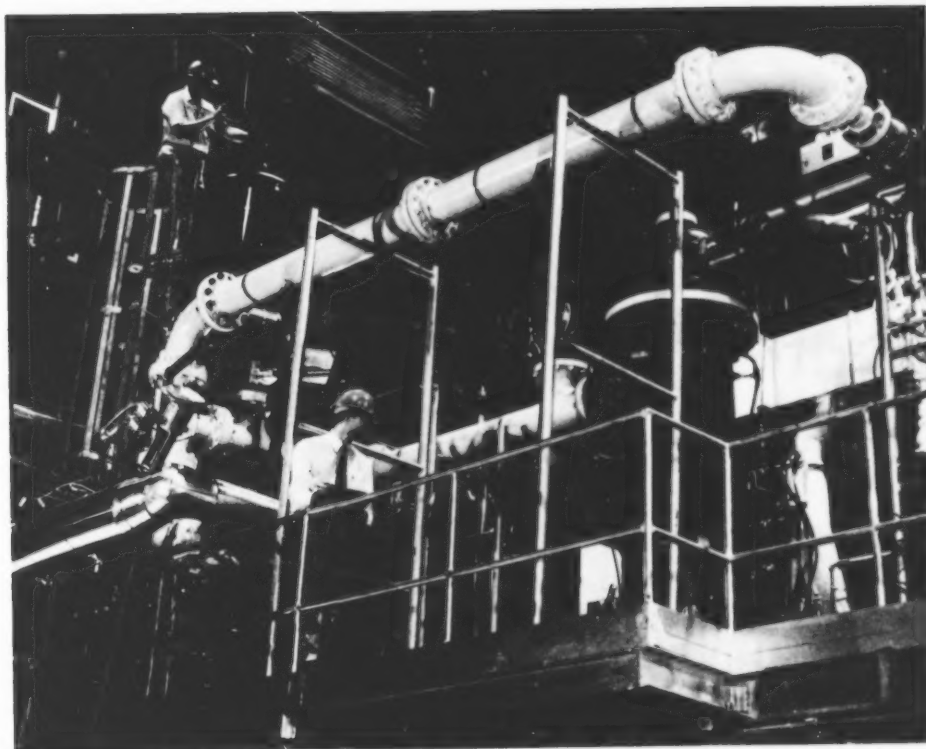
Chemical Classes

In general, the acids/bases/salts class of TRI chemicals had the highest proportion of forms reporting on-site waste treatment (67 percent), while the halo-organics had the lowest percentage of forms reporting treatment (33 percent) (Table 10-5). (Chemical classes are described in Chapter 4.) Metals and metal compounds were second highest — an average of 53 percent of the TRI forms submitted on these chemicals reported on-site treatment of wastes. Non-metallic inorganics averaged about 45 percent and organics averaged about 42 percent. Table 10-5 lists the number and percentage of forms reporting waste treatment for the five chemicals with the highest TRI releases and transfers for each chemical class.

**Acids/bases/salts
had the highest
proportion of forms
reporting on-site**

TABLE 10-5. NUMBER OF TRI FORMS REPORTING ON-SITE WASTE TREATMENT BY CHEMICAL CLASS, 1987

CHEMICAL NAME	TRI FORMS WITH WASTE TREATMENT Number	PERCENT OF ALL TRI FORMS FOR THE CHEMICAL	TOTAL TRI FORMS FOR THE CHEMICAL Number
<u>Acids/Bases/Salts</u>			
SODIUM SULFATE (SOLUTION)	745	53.18	1,401
AMMONIUM SULFATE (SOLUTION)	134	42.54	315
HYDROCHLORIC ACID	2,201	75.77	2,905
SULFURIC ACID	3,502	70.83	4,944
SODIUM HYDROXIDE (SOLUTION)	4,260	62.51	6,815
PHOSPHORIC ACID	1,273	62.16	2,048
SUBTOTAL	12,115	65.74	18,428
TOTAL FOR ALL OTHERS IN THE CLASS	2,123	77.09	2,754
TOTAL FOR CLASS	14,238	67.22	21,182
<u>Halo-organics</u>			
1,1,1-TRICHLOROETHANE	764	24.77	3,084
DICHLOROMETHANE	426	30.15	1,413
FREON 113	269	28.04	1,033
TRICHLOROETHYLENE	265	30.53	868
TETRACHLOROETHYLENE	213	33.13	643
SUBTOTAL	1,937	27.51	7,041
TOTAL FOR ALL OTHERS IN THE CLASS	896	54.80	1,635
TOTAL FOR CLASS	2,833	32.65	8,676
<u>Metals and Metal Compounds</u>			
ALUMINUM OXIDE	633	48.58	1,303
COPPER	622	47.12	1,320
ZINC COMPOUNDS	653	59.20	1,103
MANGANESE COMPOUNDS	192	56.14	342
ZINC (FUME OR DUST)	292	50.69	576
SUBTOTAL	2,392	51.51	4,644
TOTAL FOR ALL OTHERS IN THE CLASS	3,806	53.30	7,141
TOTAL FOR CLASS	6,198	52.59	11,785
<u>Non-metallic Inorganics</u>			
AMMONIA	1,084	44.77	2,421
CHLORINE	850	48.91	1,738
ARSENIC COMPOUNDS	42	20.00	210
ASBESTOS (FRIABLE)	55	35.71	154
CHLORINE DIOXIDE	86	76.11	113
SUBTOTAL	2,117	45.66	4,636
TOTAL FOR ALL OTHERS IN THE CLASS	92	36.65	251
TOTAL FOR CLASS	2,209	45.20	4,887
<u>Organic chemicals (Non-halogenated)</u>			
METHANOL	919	44.98	2,043
TOLUENE	1,177	37.08	3,174
ACETONE	778	37.24	2,089
XYLENE (MIXED ISOMERS)	996	36.07	2,761
METHYL ETHYL KETONE	685	32.59	2,102
SUBTOTAL	4,555	37.43	12,169
TOTAL FOR ALL OTHERS IN THE CLASS	6,937	46.55	14,902
TOTAL FOR CLASS	11,492	42.45	27,071
TOTAL FOR MIXTURES	215	42.24	509
TOTAL FOR TRADE SECRETS	23	54.76	42
GRAND TOTAL	37,208	50.18	74,152



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Chapter 11. Waste Minimization

Introduction

The Toxics Release Inventory (TRI) form contains an optional section on which facilities can voluntarily report information on their efforts to minimize chemical waste generation (Figure 11-1). The form requests information on how and why a facility attempted to minimize its wastes, production information, and the change in waste generation between the current and prior year.

Eleven percent of TRI facilities, or 2,090 facilities out of 19,278 TRI facilities that filed forms, reported attempts to minimize TRI chemical wastes. This represents nearly six percent of the chemical specific TRI forms submitted for 1987 (4,352 TRI forms out of a total of 74,152 filed forms).

Eleven percent of TRI facilities reported efforts to minimize their TRI chemical wastes.

Because this section contains information that was voluntarily submitted, there are limitations on interpreting the data. It is not representative of national totals. Moreover, the data may not provide a reliable basis for conclusions on the percent of respondents nationally using a particular type of action or the reason they selected the action. The data do not provide reliable national estimates of the total quantity of waste minimized.

8. OPTIONAL INFORMATION ON WASTE MINIMIZATION (Indicate actions taken to reduce the amount of the chemical being released from the facility. See the instructions for coded items and an explanation of what information to include.)			
A. Type of modification (enter code)	B. Quantity of the chemical in the wastestream prior to treatment/disposal	C. Index	D. Reason for action (enter code)
	Current reporting year (lbs/yr) Prior year (lbs/yr) Or percent change %		

EPA Form 9350-1(1-88)

Figure 11-1.
TRI Form: Waste Minimization Information, 1987.

TABLE 11-1. TRI WASTE MINIMIZATION REPORTING BY STATE, 1987

STATE	FACILITIES REPORTING WASTE MINIMIZATION		TOTAL TRI FACILITIES REPORTING		FORMS REPORTING WASTE MINIMIZATION		TOTAL TRI FORMS REPORTING	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Alabama	30	1.44	355	1.84	51	1.17	1,508	2.03
Alaska	0	0.00	7	0.04	0	0.00	53	0.07
American Samoa	0	0.00	2	0.01	0	0.00	5	0.01
Arizona	16	0.77	156	0.81	40	0.92	545	0.73
Arkansas	25	1.20	293	1.52	50	1.15	988	1.33
California	183	8.76	1,662	8.62	417	9.58	5,830	7.86
Colorado	16	0.77	172	0.89	24	0.55	540	0.73
Connecticut	38	1.82	383	1.99	57	1.31	1,412	1.90
Delaware	4	0.19	53	0.27	5	0.11	263	0.35
Florida	45	2.15	419	2.17	85	1.95	1,331	1.79
Georgia	50	2.39	636	3.30	146	3.35	2,185	2.95
Hawaii	0	0.00	33	0.17	0	0.00	122	0.16
Idaho	4	0.19	52	0.27	6	0.14	163	0.22
Illinois	127	6.08	1,185	6.15	267	6.14	4,314	5.82
Indiana	81	3.88	720	3.73	209	4.80	2,790	3.76
Iowa	30	1.44	310	1.61	64	1.47	1,012	1.36
Kansas	26	1.24	184	0.95	64	1.47	742	1.00
Kentucky	37	1.77	298	1.55	58	1.33	1,353	1.82
Louisiana	26	1.24	259	1.34	85	1.95	1,818	2.45
Maine	7	0.33	83	0.43	10	0.23	360	0.49
Maryland	24	1.15	191	0.99	33	0.76	720	0.97
Massachusetts	75	3.59	560	2.90	136	3.13	1,852	2.50
Michigan	81	3.88	758	3.93	185	4.25	3,339	4.50
Minnesota	21	1.00	301	1.56	41	0.94	1,198	1.62
Mississippi	34	1.63	247	1.28	61	1.40	876	1.18
Missouri	48	2.30	503	2.61	95	2.18	1,902	2.57
Montana	1	0.05	27	0.14	2	0.05	148	0.20
Nebraska	13	0.62	139	0.72	19	0.44	424	0.57
Nevada	1	0.05	33	0.17	1	0.02	91	0.12
New Hampshire	10	0.48	129	0.67	12	0.28	435	0.59
New Jersey	186	8.90	875	4.54	407	9.35	3,280	4.42
New Mexico	5	0.24	32	0.17	15	0.34	119	0.16
New York	78	3.73	765	3.97	131	3.01	2,836	3.82
North Carolina	90	4.31	820	4.25	247	5.68	2,792	3.77
North Dakota	4	0.19	28	0.15	4	0.09	72	0.10
Ohio	117	5.60	1,261	6.54	261	6.00	5,116	6.90
Oklahoma	20	0.96	193	1.00	30	0.69	686	0.93
Oregon	17	0.81	217	1.13	27	0.62	705	0.95
Pennsylvania	125	5.98	1,027	5.33	230	5.28	3,989	5.38
Puerto Rico	14	0.67	172	0.89	26	0.60	572	0.77
Rhode Island	27	1.29	166	0.86	46	1.06	472	0.64
South Carolina	38	1.82	394	2.04	61	1.40	1,694	2.28
South Dakota	9	0.43	37	0.19	12	0.28	75	0.10
Tennessee	46	2.20	503	2.61	73	1.68	1,889	2.55
Texas	88	4.21	999	5.18	257	5.91	5,381	7.26
Utah	18	0.86	102	0.53	26	0.60	393	0.53
Vermont	2	0.10	52	0.27	2	0.05	158	0.21
Virgin Islands	0	0.00	1	0.01	0	0.00	24	0.03
Virginia	44	2.11	399	2.07	85	1.95	1,450	1.96
Washington	28	1.34	306	1.59	51	1.17	1,091	1.47
West Virginia	16	0.77	107	0.56	25	0.57	672	0.91
Wisconsin	59	2.82	645	3.35	106	2.44	2,239	3.02
Wyoming	6	0.29	27	0.14	7	0.16	128	0.17
TOTAL	2,090	100.00	19,278	100.00	4,352	100.00	74,152	100.00



Map 11-1.
TRI Facilities Reporting Waste Minimization, 1987.

The responses are presented here because even without national totals, they provide valuable insights into the areas where waste minimization can be achieved, ways in which it can be implemented, the reasons for implementation, and ways to understand and document the success of programs to reduce waste generation. The data are also useful for examining facilities individually, rather than nationally.

Geographical Distribution

Facilities in California and New Jersey submitted the largest numbers of TRI forms with waste minimization information. In California, 183 facilities filed 417 TRI forms with waste minimization information, and in New Jersey, 186 facilities filed 407 TRI forms with the information (see Table 11-1, Map 11-1). Six additional states had more than 200 waste minimization forms each: Illinois (267 forms from 127 facilities); Ohio (261 forms from 117 facilities); Texas (257 forms from 88 facilities); North Carolina (247 forms from 90 facilities); Pennsylvania (230 forms from 125 facilities); and Indiana (209 forms from 81 facilities). Map 11-1 shows that facilities in the Mid-Atlantic and Great Lakes states and parts of the Midwest, along with North Carolina,

California and New Jersey had the most facilities reporting waste minimization.

TABLE 11-2. TRI WASTE MINIMIZATION REPORTS AS A PROPORTION OF ALL STATE REPORTS, 1987

STATE	FACILITIES REPORTING WASTE MINIMIZATION		TOTAL TRI FACILITIES FOR THE STATE	FORMS REPORTING WASTE MINIMIZATION		TOTAL TRI FORMS FOR THE STATE
	Number	PERCENT OF STATE TOTAL		Number	PERCENT OF STATE TOTAL	
Alabama	30	8.45	355	51	3.38	1,508
Alaska	0	0.00	7	0	0.00	53
American Samoa	0	0.00	2	0	0.00	5
Arizona	16	10.26	156	40	7.34	545
Arkansas	25	8.53	293	50	5.06	988
California	183	11.01	1,662	417	7.15	5,830
Colorado	16	9.30	172	24	4.44	540
Connecticut	38	9.92	383	57	4.04	1,412
Delaware	4	7.55	53	5	1.90	263
Florida	45	10.74	419	85	6.39	1,331
Georgia	50	7.86	636	146	6.68	2,185
Hawaii	0	0.00	33	0	0.00	122
Idaho	4	7.69	52	6	3.68	163
Illinois	127	10.72	1,185	267	6.19	4,314
Indiana	81	11.25	720	209	7.49	2,790
Iowa	30	9.68	310	64	6.32	1,012
Kansas	26	14.13	184	64	8.63	742
Kentucky	37	12.42	298	58	4.29	1,353
Louisiana	26	10.04	259	85	4.68	1,818
Maine	7	8.43	83	10	2.78	360
Maryland	24	12.57	191	33	4.58	720
Massachusetts	75	13.39	560	136	7.34	1,852
Michigan	81	10.69	758	185	5.54	3,339
Minnesota	21	6.98	301	41	3.42	1,198
Mississippi	34	13.77	247	61	6.96	876
Missouri	48	9.54	503	95	4.99	1,902
Montana	1	3.70	27	2	1.35	148
Nebraska	13	9.35	139	19	4.48	424
Nevada	1	3.03	33	1	1.10	91
New Hampshire	10	7.75	129	12	2.76	435
New Jersey	186	21.26	875	407	12.41	3,280
New Mexico	5	15.63	32	15	12.61	119
New York	78	10.20	765	131	4.62	2,836
North Carolina	90	10.98	820	247	8.85	2,792
North Dakota	4	14.29	28	4	5.56	72
Ohio	117	9.28	1,261	261	5.10	5,116
Oklahoma	20	10.36	193	30	4.37	686
Oregon	17	7.83	217	27	3.83	705
Pennsylvania	125	12.17	1,027	230	5.77	3,989
Puerto Rico	14	8.14	172	26	4.55	572
Rhode Island	27	16.27	166	46	9.75	472
South Carolina	38	9.64	394	61	3.60	1,694
South Dakota	9	24.32	37	12	16.00	75
Tennessee	46	9.15	503	73	3.86	1,889
Texas	88	8.81	999	257	4.78	5,381
Utah	18	17.65	102	26	6.62	393
Vermont	2	3.85	52	2	1.27	158
Virgin Islands	0	0.00	1	0	0.00	24
Virginia	44	11.03	399	85	5.86	1,450
Washington	28	9.15	306	51	4.67	1,091
West Virginia	16	14.95	107	25	3.72	672
Wisconsin	59	9.15	645	106	4.73	2,239
Wyoming	6	22.22	27	7	5.47	128
TOTAL	2,090	10.84	19,278	4,352	5.87	74,152

Georgia, Texas, and California, submitted the largest numbers of waste minimization forms.

Another way to consider the number of TRI forms with waste minimization information is to compare the proportion of all TRI forms filed for a state to the number of forms filed for the state with waste minimization information. Such an examination gives a somewhat different view of the top-ranked states. Among those listed above, New Jersey facilities filed the largest proportion of TRI forms with waste minimization information (12 percent), followed by North Carolina (9 percent), Indiana (7 percent), California (7 percent), Illinois (6 percent), Pennsylvania (6 percent), Ohio (5 percent), and Texas (5 percent) (Table 11-2).

Industries and Facilities that Practiced Waste Minimization

TRI facilities from the Chemical and Allied Products industry submitted the most TRI forms with waste minimization data (Figure 11-2) with 31 percent (1,358 forms) of all TRI forms that contained waste minimization data. Fabricated Metals facilities ranked second with 12 percent of all waste minimization forms (515 forms). Four other industries had at least 200 forms with waste minimization data filled in: the Electrical and Electronic Machinery, Equipment, and Supplies industry with 276 waste minimization reports, the Rubber and Plastics industry with 212, the Furniture and Fixtures industry with 210 reports, and the Primary Metals industry with 204 reports.

Facilities in the Chemical industry submitted one third of the total TRI forms that contained waste minimization data.

Facilities classified under multiple industrial categories submitted a total of 261 waste minimization forms (6 percent of the total). Facilities from industries that were not required to report because they were not classified as manufacturing industries submitted three percent of the total waste minimization forms (114).

Just two industries accounted for more than one-third of the forms reporting waste minimization efforts. The highest percentage was the Chemical and Allied Products industry with 31 percent reporting (1,358 out of the total of 4,352 forms reporting waste minimization) and the Fabricated Metals industry with 12 percent (515 forms).

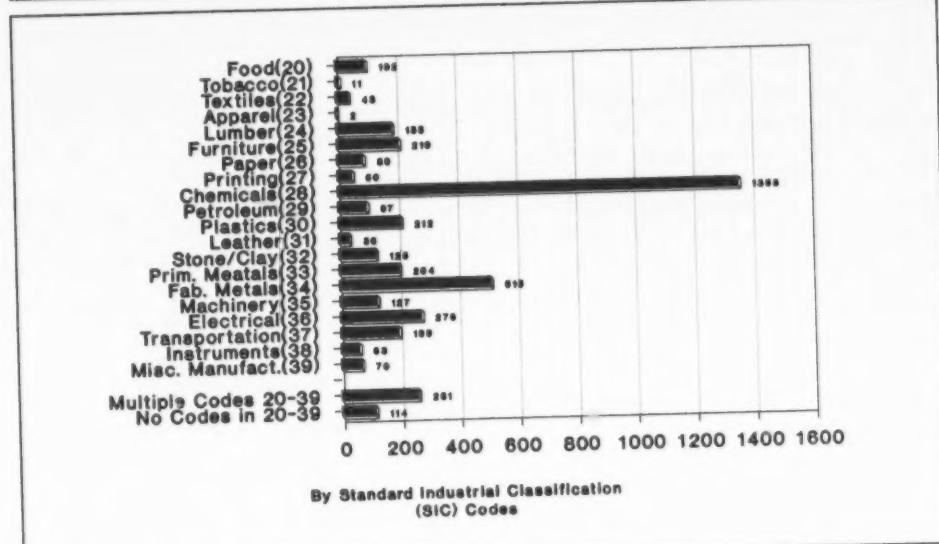


Figure 11-2.
Number of Waste Minimization Forms by Industry, 1987.

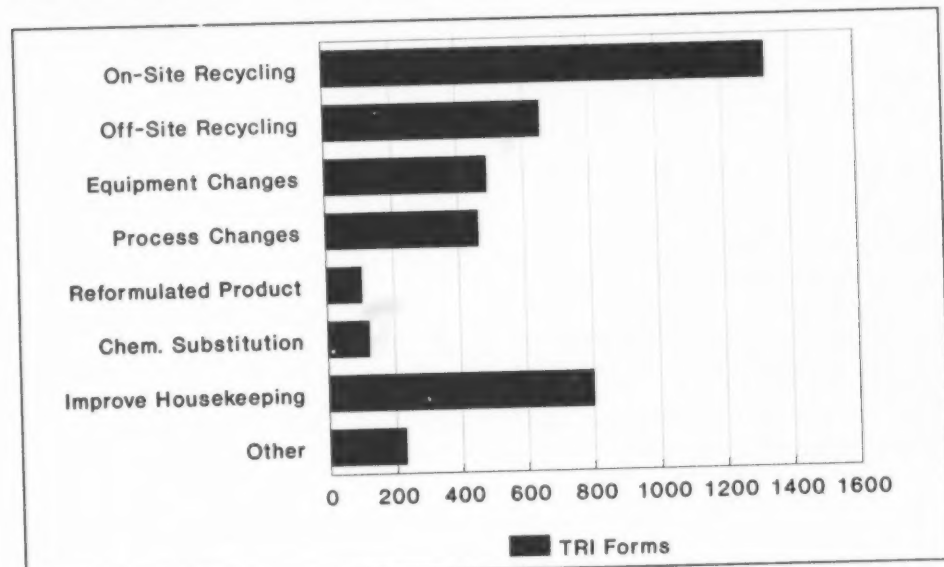


Figure 11-3.
TRI Waste Minimization by Method, 1987.

How and Why Facilities Attempted to Minimize their Wastes

Waste Minimization Methods

TRI asked facilities which one of eight possible methods they used in attempting to minimize waste. The most often-reported method of waste minimization was **on-site reuse or recycling**, which was selected on 32 percent of all waste minimization forms that listed a method—1,332 out of 4,196 forms providing a method (Figure 11-3). **Improved housekeeping, training, and inventory control** ranked second; this method was reported on 19 percent of the waste minimization forms (801 forms). **Off-site recycling or reuse** was reported on 16 percent of the forms (655). Nearly 12 percent of the forms (489) indicated attempts to minimize wastes by **equipment or technology modification**, and another 11 percent identified **process procedure modifications** (461). Three methods—**product reformulation or redesign**, **substitution of raw materials**, and **other techniques**—were each reported on less than six percent of the TRI forms.

On-site recycling was the waste minimization method most frequently reported by TRI facilities.

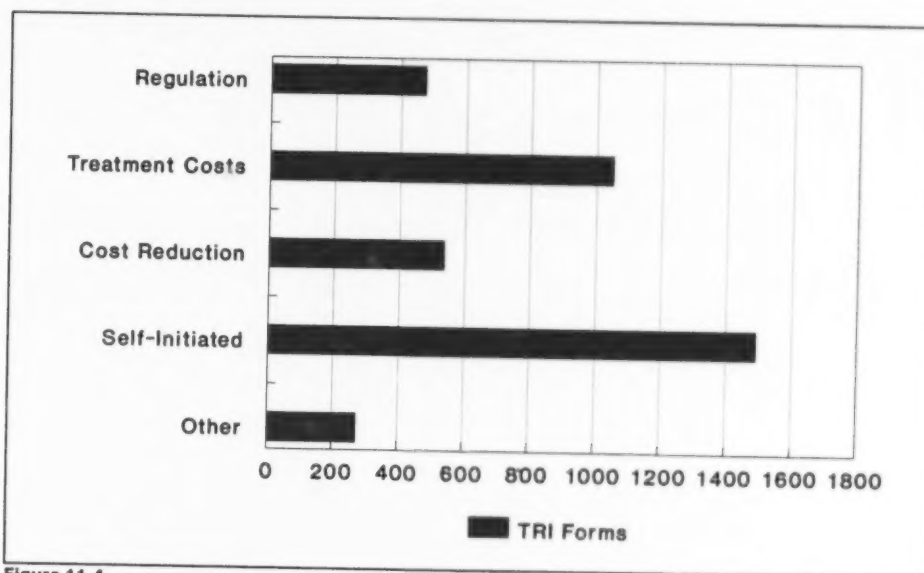


Figure 11-4.
TRI Waste Minimization by Reason, 1987.

"Self-initiated review" was the most frequently-cited reason for waste minimization,

Reasons for Waste Minimization

TRI also asked facilities to volunteer information on their reasons for initiating waste minimization efforts; the form provided five choices. Thirty-nine percent of the waste minimization forms (1,492 of the 3,826 forms providing a reason) identified **self-initiated review** as the primary reason for attempting to minimize wastes (Figure 11-4). **Reduction of treatment or disposal costs** was cited in 28 percent of the forms (1,051 forms), followed by **other process cost reductions** with 14 percent (537). **Regulatory requirements for the waste** was the reason listed in 12 percent of the forms (474). The fewest forms (seven percent) indicated **other reasons** (discontinuation of a product, occupational safety, etc.).

Chemicals Targeted For Waste Minimization

Numbers of Chemicals per Facility

Over half of the facilities reporting waste minimization information to TRI did so for only one chemical.

Approximately 60 percent of the TRI facilities that filled out the waste minimization section did so for only one chemical (Table 11-3). Another 18 percent of the facilities reported that they attempted to minimize wastes for two chemicals, and nine percent of these facilities reported three chemicals. A few facilities reported efforts to minimize a wide range of chemicals. Thirty-three facilities (approximately 1.5 percent of all facilities that reported waste minimization) filled out waste minimization for ten or more chemicals.

TABLE 11-3. DISTRIBUTION OF NUMBER OF TRI CHEMICALS REPORTED WITH WASTE MINIMIZATION PER FACILITY, 1987

NUMBER OF TRI CHEMICALS WITH WASTE MINIMIZATION	NUMBER OF FACILITIES REPORTING	PERCENT OF TOTAL	CUMULATIVE PERCENT
1	1,245	59.57	59.57
2	385	18.42	77.99
3	187	8.95	86.94
4	84	4.02	90.96
5	60	2.87	93.83
6	41	1.96	95.79
7	22	1.05	96.84
8	13	0.62	97.46
9	20	0.96	98.42
10	12	0.57	99.00
11	8	0.38	99.38
12	1	0.05	99.43
13	2	0.10	99.52
14	1	0.05	99.57
15	2	0.10	99.67
17	1	0.05	99.71
20	1	0.05	99.76
21	1	0.05	99.81
22	2	0.10	99.90
25	1	0.05	99.95
37	1	0.05	100.00
TOTAL	2,090	100.00	

The average number of forms with waste minimization information per facility was just over two. In contrast, TRI facilities reported an average of four chemicals per facility.

Individual Chemicals

Facilities reported efforts to minimize 1,1,1-trichloroethane wastes more than any other chemical: 329 TRI forms noted attempts to minimize wastes of the chemical, which represents eight percent of the 4,352 forms with waste minimization data (Table 11-4). Toluene ranked second, with 291 forms filed with waste minimization information. Other chemicals for which more than 100 waste minimization forms were submitted included sodium hydroxide, xylene (mixed isomers), acetone, methyl ethyl ketone, sulfuric acid, dichloromethane, methanol, hydrochloric acid, and trichloroethylene.

The chemicals most often the subject of waste minimization were 1,1,1-trichloroethane and toluene.

TABLE 11-4. THE 25 TRI CHEMICALS WITH THE LARGEST NUMBER OF FORMS REPORTING WASTE MINIMIZATION, 1987

CHEMICAL NAME	TRI FORMS REPORTING WASTE MINIMIZATION		TOTAL NO. OF TRI FORMS	
	Number	Percent	Number	Percent
1,1,1-TRICHLOROETHANE	329	7.56	3,084	4.16
TOLUENE	291	6.69	3,174	4.28
SODIUM HYDROXIDE (SOLUTION)	256	5.88	6,815	9.19
XYLENE (MIXED ISOMERS)	236	5.42	2,761	3.72
ACETONE	186	4.27	2,089	2.82
METHYL ETHYL KETONE	175	4.02	2,102	2.83
SULFURIC ACID	155	3.56	4,944	6.67
DICHLOROMETHANE	142	3.26	1,413	1.91
METHANOL	134	3.06	2,043	2.76
HYDROCHLORIC ACID	102	2.34	2,905	3.92
TRICHLOROETHYLENE	100	2.30	868	1.17
FREON 113	96	2.21	1,033	1.39
AMMONIA	90	2.07	2,421	3.26
TETRACHLOROETHYLENE	86	1.98	643	0.87
ISOPROPYL ALCOHOL (MANUFACTURING)	79	1.82	650	0.88
PHOSPHORIC ACID	78	1.75	2,048	2.76
CHROMIUM	74	1.70	827	1.12
TOTAL FOR MIXTURES	74	1.70	506	0.69
COPPER	73	1.68	1,320	1.78
ALUMINUM OXIDE	72	1.65	1,303	1.76
NITRIC ACID	63	1.45	1,688	2.28
ETHYLENE GLYCOL	59	1.36	1,192	1.61
CHROMIUM COMPOUNDS	59	1.36	847	1.14
GLYCOL ETHERS	58	1.33	1,035	1.40
ZINC COMPOUNDS	56	1.29	1,103	1.49
SUBTOTAL	3,121	71.71	48,817	65.83
TOTAL FOR ALL OTHERS	1,231	28.29	25,335	34.17
GRAND TOTAL	4,352	100.00	74,152	100.00

TABLE 11-5. THE 25 TRI CHEMICALS WITH THE HIGHEST PROPORTION OF FORMS REPORTING WASTE MINIMIZATION, 1987

CHEMICAL NAME	Number	FORMS REPORTING WASTE MINIMIZATION		TOTAL TRI FORMS Number
			PERCENT OF TOTAL TRI FORMS FOR THE CHEMICAL	
PROPOXUR	4	66.67		6
METHOXYCHLOR	2	50.00		4
2,4,6-TRICHLOROPHENOL	1	50.00		2
C.I. BASIC GREEN 4	2	33.33		6
CHLORAMBEN	1	33.33		3
METHYLENE BROMIDE	2	26.57		7
2-PHENYLPHENOL	3	25.00		12
LINDANE	1	25.00		4
NITRILOTRIACETIC ACID	3	21.43		14
2-NITROPROPANE	3	21.43		14
DICHLORVOS	1	20.00		5
ARSENIC	19	18.27		104
1,2-DICHLOROETHYLENE	2	18.18		11
P-CRESOL	3	17.85		17
1,4-DICHLOROBENZENE	3	17.85		17
METHYL ISOCYANATE	2	16.67		12
CHLOROTHALONIL	1	16.67		6
2,4-DICHLOROPHENOL	1	16.67		6
BROMOMETHANE	3	15.79		19
HEXACHLOROETHANE	3	15.79		19
P-PHENYLENEDIAMINE	2	15.38		13
ASBESTOS (FRIABLE)	23	14.94		154
SEC-BUTYL ALCOHOL	11	14.67		75
TOTAL FOR MIXTURES	74	14.54		509
DICHLOROBROMOMETHANE	1	14.29		7
SUBTOTAL	171	16.35		1,046
TOTAL FOR ALL OTHERS	4,181	5.72		73,106
GRAND TOTAL	4,352	5.87		74,152

The percentage of TRI forms submitted for these chemicals that had waste minimization information ranged from four percent for hydrochloric acid and sodium hydroxide to 11 percent for 1,1,1-trichloroethane and trichloroethylene. The chemicals with the highest percentage of forms with waste minimization data reported were generally chemicals with few forms submitted (Table 11-5). Only three of these TRI chemicals — asbestos (15 percent), arsenic (18 percent), and sec-butyl alcohol (15 percent) — had as many as ten forms submitted with waste minimization data filled in (23, 19, and 11 forms respectively).

Waste Minimization Data on Volume Reductions

Creating a Subset

The data presented earlier in this chapter deals with numbers of waste minimization forms, and the distribution of these 4,352 forms amongst states, industries, and chemicals. Waste minimization forms also contained data on volumes of waste reduced, but for several reasons, the full set of waste minimization forms could not be analyzed for volume information. Many of the forms submitted did not contain volume data or contained incomplete data. Others gave numbers that were obviously in error. For this reason, a subset of waste minimization forms was chosen. Forms that met the following criteria were included in the subset:

- contained volume data
- contained data on production index, method, and reason
- contained clear-cut reductions in waste, that is, 1987 waste generation was less than that in 1986

A total of 802 forms out of the 4,352 waste minimization forms, met the above criteria and were included in the subset.

Volume Reductions in Waste Generation

The 802 waste minimization forms included in the aforementioned subset of data reported amounts of TRI chemical waste for both 1986 and 1987. TRI waste generation for the subset was 121 million pounds in 1986, and only 69 million pounds in 1987 for an overall reduction of 43 percent (52 million pounds) (Figure 11-5). The reports were filed by 462 facilities, or an average of almost two waste minimization forms per facility.

Fifty-two million pounds of TRI wastes were reported reduced between 1986 and 1987 (within a subset of forms).

Geographical Distribution

Within the waste minimization subset, facilities in Michigan and Texas reported the largest overall amounts of waste minimization, with 12 and 9 million pounds, respectively. Four other states had more than two million pounds of reductions: Louisiana (4.5 million pounds), and South Carolina, Pennsylvania and Illinois, each reporting about three million pounds of waste minimization (Figure 11-6, Table 11-6). Facilities in Louisiana also reported the largest percentage reduction of wastes (88 percent) for any of the larger states; New Mexico was the only state reporting a larger percent reduction (98 percent) although the overall quantities involved were relatively small.

Within a subset of waste minimization data, Michigan and Texas reported the largest overall reductions.

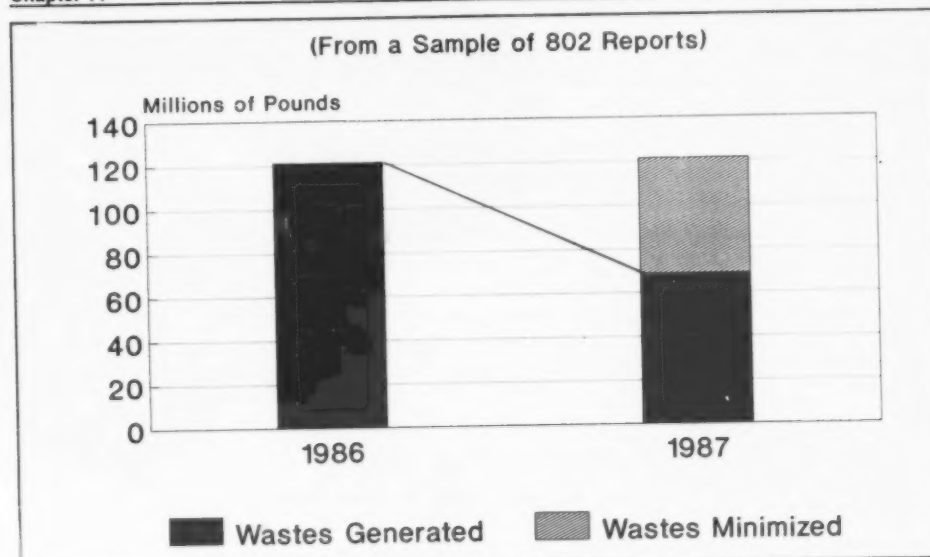


Figure 11-5.

TRI Waste Minimization, 1987: Pounds of Wastes Minimized, 1987.

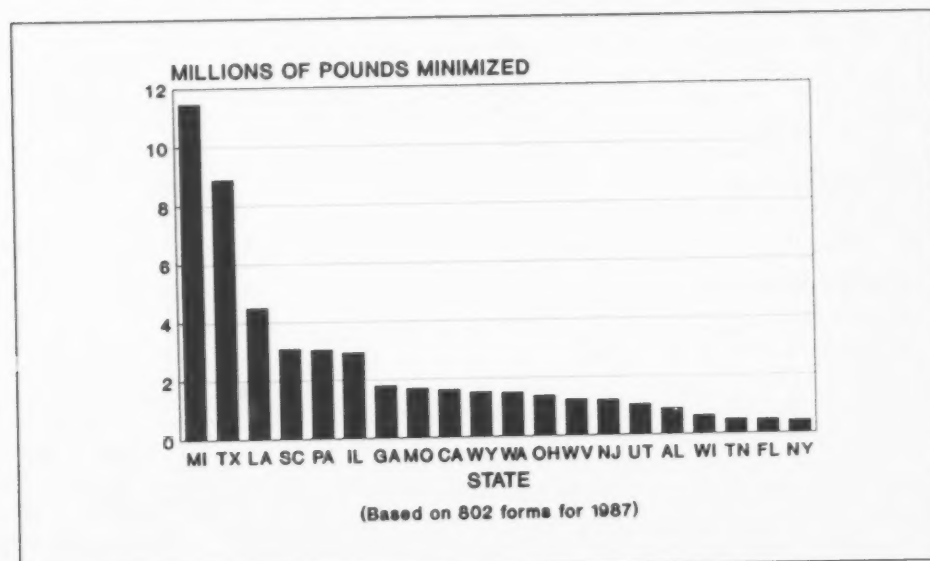


Figure 11-6.

The Top 20 States for Amount of TRI Waste Minimization, 1987

TABLE 11-6. AMOUNT OF TRI WASTE MINIMIZATION BY STATE, 1987
(From a sample of 802 TRI forms)

STATE	TRI WASTE GENERATION		AMOUNT OF TRI WASTES REDUCED	PERCENT REDUCED
	1987 Pounds	1986 Pounds		
AL	4,540,285	5,423,853	883,568	16.3
AR	632,100	806,955	174,855	21.7
AZ	11,050	20,700	9,650	46.6
CA	2,391,763	3,988,314	1,596,551	40.0
CO	16,144	43,994	27,850	63.3
CT	739,867	998,753	258,886	25.9
DE	13,830	20,000	6,170	30.9
FL	400,972	858,202	457,230	53.3
GA	614,175	2,377,707	1,763,532	74.2
IA	620,270	766,539	146,269	19.1
IL	4,670,265	7,582,140	2,911,875	38.4
IN	357,852	687,877	330,025	48.0
KS	176,935	204,354	27,419	13.4
KY	391,732	788,128	396,396	50.3
LA	617,244	5,105,646	4,488,402	87.9
MA	321,449	423,626	102,177	24.1
MD	710,956	795,891	84,935	10.7
ME	4,800	6,000	1,200	20.0
MI	4,563,661	16,026,122	11,462,461	71.5
MN	110,352	141,192	30,840	21.8
MO	16,138,637	17,794,663	1,656,026	9.3
MS	237,633	264,785	27,152	10.3
MT	700	900	200	22.2
NC	1,202,657	1,587,514	384,857	24.2
NE	259,620	380,016	120,396	31.7
NH	189,255	297,414	108,159	36.4
NJ	3,036,082	4,221,844	1,185,762	28.1
NM	254	13,450	13,196	98.1
NY	594,299	1,014,376	420,077	41.4
OH	3,448,604	4,808,213	1,359,609	28.3
OK	89,991	114,090	24,099	21.1
OR	254,198	349,772	95,574	27.3
PA	3,207,628	6,231,815	3,024,187	48.5
PR	52,185	88,694	36,509	41.2
RI	452,259	790,022	337,763	42.8
SC	1,370,074	4,443,968	3,073,894	69.2
SD	5,050	6,616	1,566	23.7
TN	318,924	797,590	478,666	60.0
TX	9,811,892	18,687,035	8,875,143	47.5
UT	1,291,497	2,312,760	1,021,263	44.2
VA	139,802	263,437	123,635	46.9
VT	50,945	61,134	10,189	16.7
WA	2,015,808	3,506,558	1,490,750	42.5
WI	841,283	1,457,132	615,849	42.3
WV	1,524,461	2,758,275	1,233,814	44.7
WY	509,400	2,032,040	1,522,640	74.9
TOTAL	68,948,840	121,350,106	52,401,266	

The list of states with the largest quantities of waste minimization is very different from the list in Table 11-1 of the states with the largest numbers of forms reporting waste minimization data. Much of the reason for this difference is the impact of individual large-volume reductions on the overall data: a single form for Michigan, for example, reported waste minimization of 6.6 million pounds, more than half of the total for that state. Bear in mind, also, that the two sets of data are based on a different universe of forms, and must be interpreted with caution.

Waste Minimization Methods

On-site recycling accounted for the largest amount of waste minimization within the subset.

Within the waste minimization subset, on-site recycling achieved the largest amount of waste minimization, accounting for 21 million pounds (40 percent of the wastes generated in 1986) of overall reductions in waste. On-site recycling achieved a high proportion of waste minimization as well, reducing wastes by more than 50 percent. Off-site recycling accounted for both a smaller quantity (4.5 million pounds) and lesser percent reduction (37 percent) than did on-site recycle methods. Both on-site and off-site recycling were reported more frequently than any other waste minimization method with 224 and 126 forms, respectively (Figure 11-7, Table 11-7).

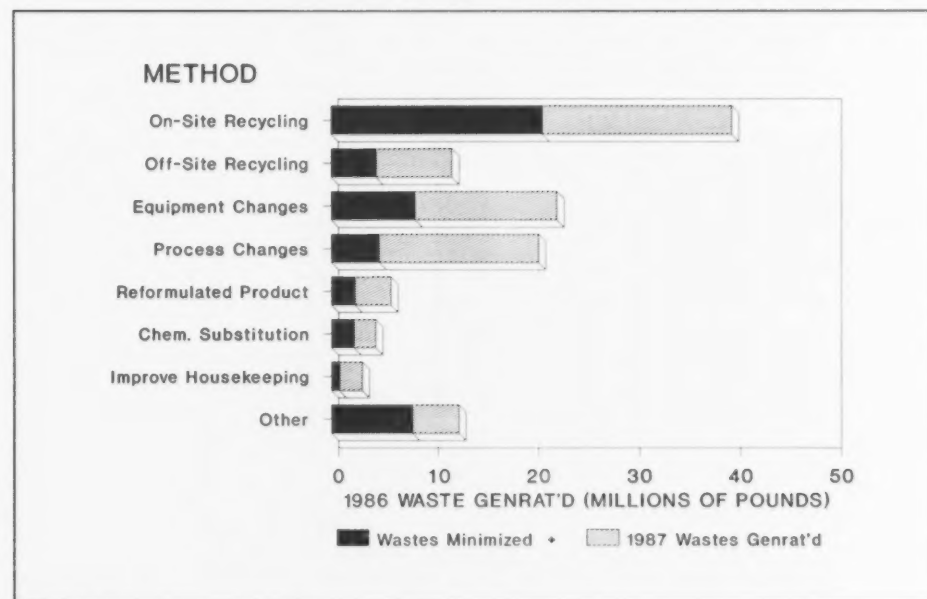


Figure 11-7.
Amount of TRI Waste Minimization by Method, 1987. (Based on 802 forms for 1987.)

TABLE 11-7. AMOUNT OF TRI WASTE MINIMIZATION BY METHOD, 1987
(From a sample of 802 TRI forms)

METHOD	TRI WASTE GENERATION			AMOUNT OF TRI WASTES REDUCED	PERCENT CHANGE
	FORMS Number	1987 Pounds	1986 Pounds		
Recycling/Reuse On-Site	224	18,707,656	39,797,950	21,090,294	53
Equip./Technology Modifications	115	14,095,067	22,556,259	8,461,192	38
Other Techniques	61	4,576,129	12,731,974	8,155,845	64
Process Procedure Modifications	104	15,929,784	20,717,421	4,787,637	23
Recycling/Reuse Off-Site	126	7,620,462	12,102,795	4,482,333	37
Product Reformulation/ Redesign	29	3,566,733	5,932,720	2,365,987	40
Substitution of Raw Materials	33	2,151,481	4,423,236	2,271,755	51
Improved Housekeeping, etc.	110	2,301,528	3,087,751	786,223	25
TOTAL	802	68,948,840	121,350,106	52,401,266	

Equipment/technology modifications were cited by 115 forms as the method of waste minimization and achieved substantial reductions of 8.5 million pounds, a reduction from the 1986 volume of 38 percent. Process changes also resulted in sizable reductions of 4.8 million pounds, although the percent reductions were a more modest 23 percent.

The two methods cited least often were product reformulation/redesign (29 forms) and substitution of raw materials (33 forms). However, both categories achieved fairly large percent reductions (40 percent and 51 percent respectively) for volume reductions of over two million pounds each.

Improved housekeeping, training, inventory control was cited on 110 forms but achieved small reductions overall both in terms of percent reduction (25 percent) and volume reduction (0.8 million pounds).

Only 61 of the 802 forms cited the category of other techniques as their waste minimization method, but the impact was surprisingly large: a 64 percent reduction of 8.1 million pounds.

"Self-initiated review" was the most frequently cited reason for waste minimization efforts, and it produced the largest percentage of waste minimization

Reasons for Waste Minimization

Self-initiated review was the most frequently cited reason for implementing waste minimization (290 forms) in the waste minimization subset, and also produced the largest percent reductions (50 percent of the waste generated in 1986) and the greatest overall amount (27 million pounds) of waste minimization (Figure 11-8, Table 11-8).

The category of **other cost reductions** (e.g. process costs) was only cited on 99 forms, but produced overall reductions in waste of 12 million pounds, a 39 percent reduction. **Reduction in treatment and disposal costs** was cited far more often (256 forms) but produced smaller quantities (8.2 million pounds) and percent (36 percent) of waste minimization.

Waste minimization motivated by **regulatory requirements**, cited on 99 forms, yielded 4.1 million pounds of reduced wastes.

Other reasons, such as the discontinuation of a product line, resulted in small numbers of forms and overall volume and percent reductions.

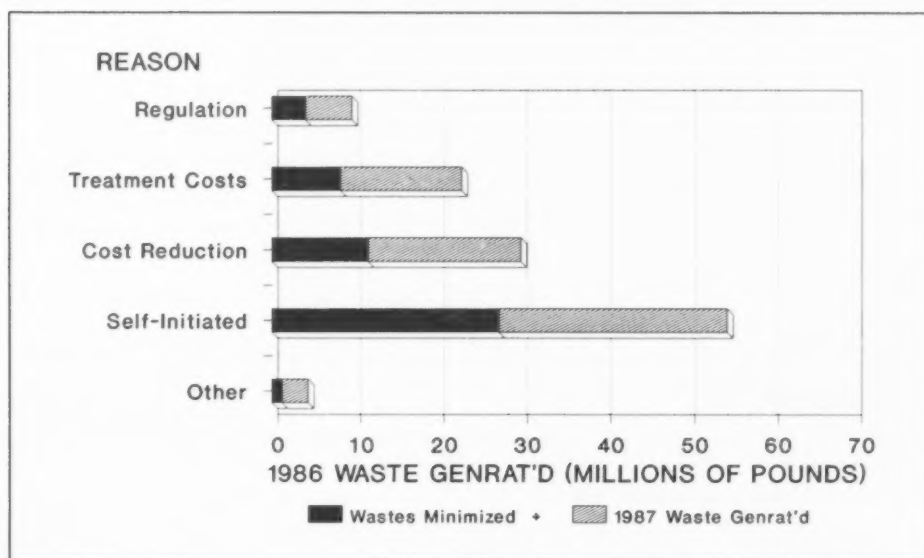


Figure 11-8.
Amount of TRI Waste Minimization by Reason, 1987. (Based on 802 forms.)

TABLE 11-8. AMOUNT OF TRI WASTE MINIMIZATION BY REASON, 1987
(From a sample of 802 TRI forms)

REASON	TRI WASTE GENERATION			AMOUNT OF TRI WASTES REDUCED	PERCENT CHANGE
	FORMS Number	1987 Pounds	1986 Pounds		
Self Initiated Review	290	27,275,721	54,564,167	27,288,446	50
Other Process Cost Reduction	99	18,299,491	29,927,166	11,627,675	39
Reduction of Treatment/Disposal Costs	256	14,574,884	22,819,727	8,244,843	36
Regulatory Requirements	99	5,579,368	9,663,032	4,083,664	42
Other	58	3,219,376	4,376,014	1,156,638	26
TOTAL	802	68,948,840	121,350,106	52,401,266	

Chemicals Subject to Waste Minimization

Sodium sulfate and sodium hydroxide (both of which EPA has proposed removing from the TRI list) were the chemicals subject to the greatest amounts of waste minimization in the waste minimization subset, 6.6 and 4.8 million pounds respectively. Three other chemicals (propylene, 2,4-D acid, and acetaldehyde), were reduced in quantities of more than three million pounds. For each of these five chemicals, a single waste minimization form dominated the total amount of waste reductions. In fact, there were only two waste minimization forms for sodium sulfate, and one each for 2,4,-D acid and acetaldehyde in the subset.

Sodium sulfate and sodium hydroxide were the chemicals with the greatest reported waste minimization in the subset of 802 forms.

TABLE 11-9 TRI CHEMICALS MINIMIZED BY MORE THAN ONE MILLION POUNDS, 1987
(From a sample of 802 forms)

CHEMICAL	TRI WASTE GENERATION		AMOUNT OF TRI WASTES REDUCED	NO. OF TRI REPORTS	LARGEST SINGLE REPORT
	1987 Pounds	1986 Pounds			
SODIUM SULFATE	1,492,642	8,095,022	6,602,380	2	6,578,080
SODIUM HYDROXIDE	7,004,418	11,793,130	4,788,712	24	2,890,000
PROPYLENE	800,340	4,328,300	3,527,960	4	3,360,000
2,4-DICHLOROPHENOXYACETIC ACID	28,216	3,282,896	3,254,680	1	3,254,680
ACETALDEHYDE	0	3,100,000	3,100,000	1	3,100,000
CHLOROBENZENE	2,115,000	4,690,000	2,575,000	1	2,525,000
ALUMINUM OXIDE	2,415,497	4,797,518	2,382,021	10	876,800
AMMONIA	4,996,079	6,956,332	1,960,253	15	1,278,149
ASBESTOS	2,170,727	4,072,338	1,901,611	5	1,780,000
XYLENE	1,776,758	3,573,112	1,796,354	37	65,984
DICHLOROMETHANE	2,393,536	4,143,209	1,749,673	65	815,561
1,1,1-TRICHLOROETHANE	2,219,008	3,885,577	1,666,569	73	69,800
METHYL ETHYL KETONE	6,136,780	7,714,626	1,577,846	45	808,000
TOLUENE	2,060,325	3,597,209	1,536,884	70	424,800
SULFURIC ACID	1,973,951	3,300,775	1,326,824	19	669,286

For the subset of forms, greater levels of waste minimization were achieved by facilities expanding their production.

Ten other chemicals were reduced by more than a million pounds (Table 11-9). For most of these, a single large form dominated the overall total reductions in waste. The exception was xylene, which had 37 forms for a total reduction of waste of 1.8 million pounds; the largest single form was for 65,984 pounds.

Waste Minimization by Production Index

Companies in the waste minimization subset also provided production index data with their forms. The production index is an indicator selected by the facility (such as number of cars; square feet of tape; pounds of chemicals, and so on as appropriate) to quantify overall levels of production activity. The production index is reported as a ratio of current year to prior year production: if production has doubled, the production index is 2.0, if it has halved, the index is 0.5.

Over 25 percent of the waste minimization subset reported a production index of 1.0, indicating no change from 1986 production levels. This group reported overall reductions of 45 percent from 1986 levels and accounted for 11 million pounds of reduced wastes out of the total of 52 million (Table 11-10).

More than 50 percent of the subset had production indexes in a range of 0.9 - 1.1. However, those reporting a production index of 1.1 or 0.9 had considerably smaller total reductions and percent reductions than did those with a production index of 1.0.

Facilities reporting indexes at the high and low end of production indexes indicated they were particularly effective in reducing their waste generation; production indexes greater than 2.0 had an overall

TABLE 11-10. AMOUNT OF TRI WASTE MINIMIZATION BY PRODUCTION INDEX, 1987
(From a sample of 802 TRI forms)

TRI PRODUCTION INDEX	TRI FORMS Number	WASTE GENERATION		AMOUNT OF TRI WASTES REDUCED	PERCENT CHANGE
		1987 Pounds	1986 Pounds		
>2	32	3,262,167	10,697,206	7,435,039	70
1.3-2	114	8,813,158	18,345,058	9,531,900	52
1.2	102	4,004,765	9,315,334	5,310,569	57
1.1	156	15,353,294	19,364,460	4,011,166	21
1.0	206	13,829,379	24,961,299	11,131,920	45
0.9	66	11,349,257	13,743,580	2,394,323	17
0.5-0.8	100	11,308,185	19,250,200	7,942,015	41
<0.5	26	1,028,635	5,672,969	4,644,334	82
	802	68,948,840	121,350,106	52,401,266	43

reduction of 70 percent, while production indexes of less than 0.5 reported reductions of 82 percent (a very different picture emerges when considering relative waste minimization — see below). The largest production index reported was 9.9, the smallest, 0.1.

The availability of the production index provides an important additional perspective on TRI waste minimization data. The volumes reported thus far in this chapter represent **absolute quantities** of waste minimization, that is, changes in waste at a facility without regard to changes in production. Another way to examine the data is to use production indexes to generate **relative quantities** of waste minimization (see Box 11-A).

Relative and Absolute Waste Minimization

As detailed earlier, the waste minimization subset reported overall waste generation in 1986 of 121 million pounds, and generation in 1987 of 69 million pounds. Factoring in the impact of production indexes leads to a projected 1987 waste generation of 178 million pounds. Hence, the relative amount of waste minimization is the difference between projected and actual waste generation for 1987 or a 61 percent reduction of 109 million pounds, more than double the ab-

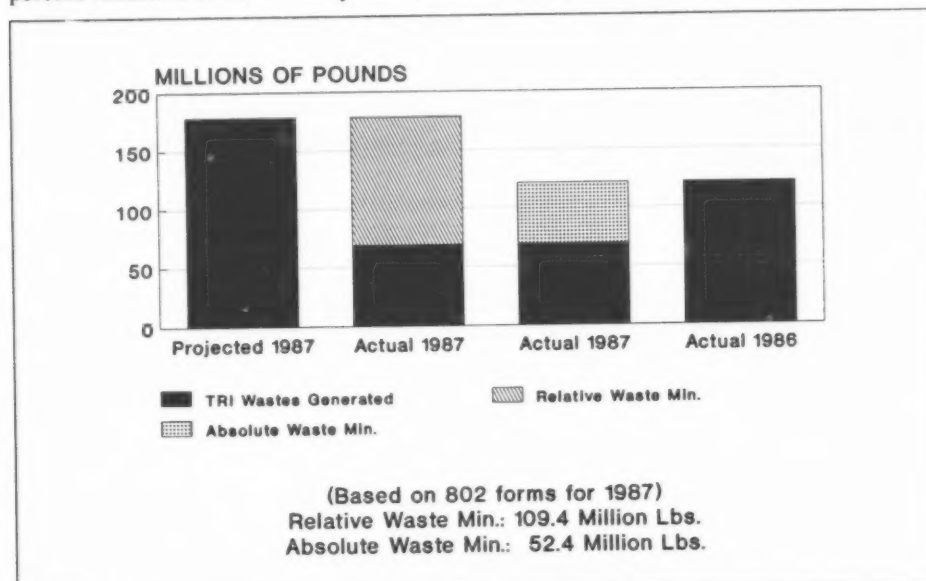


Figure 11-9
Relative vs. Absolute TRI Waste Minimizations, 1987.

Absolute and Relative Waste Minimization: The Impact of Production Index Data

The availability of production index data lends additional perspective to an understanding of waste minimization. As an example, consider the waste minimization data reported by one facility for propylene:

- WASTE GENERATION IN 1986: 3,900,000 pounds
- WASTE GENERATION IN 1987: 540,000 pounds
- PRODUCTION INDEX: 2.0
- METHOD: On-site recycle
- REASON: Cost Reductions

In absolute terms, the waste minimization achieved was simply the difference between waste generation in 1986 and 1987:

3,900,000	–	540,000	=	3,360,000 pounds
Actual 1986 Waste		Actual 1987 Waste		Absolute Waste Minimization

In other words, this facility reduced their waste generation by 3.36 million pounds by on-site recycling.

However, the production index of 2.0 tells us that the level of activity at the plant *doubled* in 1987 over the level of 1986 activity. If waste generation had followed suit, it too would have doubled from 3.9 to 7.8 million pounds. Hence, the **relative** amount of waste minimization can be thought of as the difference between what was produced in 1987 and a projection of what *would have been* produced based on production index information:

7,800,000	–	540,000	=	7,260,000 pounds
Projected 1987 Waste		Actual 1987 Waste		Relative Waste Minimization

This facility's waste generation was 7.26 million pounds less in 1987 than what it would have been if the waste generation had increased at the same pace as production increases.

Box 11-A.

solute volume (Figure 11-9). The increase is due to the fact that the effect of production increases (production index greater than 1.0) outweighs the impact of decreases (production index less than 1.0).

The relative waste minimization data present a strikingly different picture of reductions according to production index than that presented in Figure 11-9 and Table 11-11. Facilities with large produc-

A decrease in production activity also casts an interesting light on waste minimization data, as can be seen by the following data on trichloroethane:

- WASTE GENERATION IN 1986: 1,479,000 pounds
- WASTE GENERATION IN 1987: 781,000 pounds
- PRODUCTION INDEX: 0.5
- METHOD: Substitution
- REASON: Self-initiated review

In this case, the absolute reduction in trichloroethane waste is 698,000 pounds. However, the production index of 0.5 indicates activity in 1987 was half of that in 1986; projected waste generation would also then be half of 1,479,000 pounds, or 739,500 pounds:

$$\begin{array}{rcccl}
 739,500 & - & 781,000 & = & - 41,500 \text{ pounds} \\
 \text{projected 1987 waste} & & \text{actual 1987 waste} & & \text{relative waste minimization}
 \end{array}$$

The actual waste generation in 1987 was greater than what would be expected based on the production index alone, resulting in a *negative* quantity of relative waste minimization. In this case, even though overall quantities of waste decreased, the amount of waste *per unit of production* increased.

TRI data alone cannot provide detailed explanations of why such a result comes about; additional information about operations at the facility would be needed to further explore the reasons for the difference in absolute and relative waste minimization.

Box 11-A, Continued.

tion indexes achieved large, in some cases very large, relative waste minimization. Those that more than doubled their production achieved a relative reduction of 95 percent over that which would have been expected. At the smaller end of the scale, the story appears to be quite different.

Much of the reported waste minimization at facilities with production indexes of less than 1.0 appears to be linked to the actual decreases in

production levels. For those whose production index was less than 0.5, waste generation did not decrease as much as production did, producing a negative value of waste minimization (see Box 11-A). This result could indicate that, at some facilities, waste generation is not well-linked to production levels and does not decrease as rapidly (resulting in a reported *increase* in the quantity of waste per unit of production). Other explanations are also possible, including errors in reporting. Additional details about facility operations would be needed to further explore the reasons for the apparent negative waste minimization.

TABLE 11-11. RELATIVE TRI WASTE MINIMIZATION BY PRODUCTION INDEX, 1987
(From a Sample of 802 Forms)

PRODUCTION INDEX RANGE	PROJECTED TRI WASTE GENERATION 1987 Pounds	ACTUAL TRI WASTE GENERATION 1987 Pounds	RELATIVE TRI WASTE MINIMIZATION Pounds	PERCENT REDUCED
>2.0	65,383,423	3,262,167	62,121,256	95.0
1.3-2.0	29,843,578	8,813,158	21,030,420	70.5
1.2	11,178,400	4,004,765	7,173,635	64.2
1.1	21,300,906	15,353,294	5,947,612	27.9
1	24,961,299	13,829,379	11,131,920	44.6
0.9	12,369,222	11,349,257	1,019,965	8.2
0.5-0.8	12,300,294	11,308,185	992,109	8.1
<0.5	1,023,157	1,028,635	-5,478	-0.5

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Chapter 12. Other Uses for the Toxics Release Inventory

Introduction

Previous chapters of this report examined the broad national perspectives available from 1987 Toxics Release Inventory (TRI) data. However, TRI data can be analyzed at different levels according to needs and interests. The national analyses presented in preceding chapters can be focussed to provide greater detail about particular topics. Many analyses can also be conducted on a regional, state, or local level.

TRI data can also provide information at the regional, state and local levels and for particular chemicals or facilities.

This chapter explores different avenues of analysis, with selected illustrative examples. The chapter does not present an exhaustive survey, but suggests the range and types of analyses possible using TRI data.

Other National Analyses

Earlier chapters examined a range of topics, such as national patterns of TRI chemical releases and transfers by the major manufacturing industries, releases and transfers associated with different industrial activities, individual chemicals and chemical classes accounting for large releases and transfers, and where chemicals were released or transferred. The following sections show how these analyses could be redirected or narrowed to address specific questions.

Analyzing Industries and Facilities

This report analyzed industries using the broadest industrial categories, as defined by the first two digits of the four-digit Standard Industrial Classification (SIC) codes (see Chapter 3 and Appendix C). Using this system, all Chemical and Allied Products industries (SIC Code 28) were included in a single group, all Petroleum Refining and Related industries (SIC Code 29) were considered as another group, and so on. However, industries covered by TRI can be analyzed in greater detail by examining the first three digits of the four-digit SIC code.

TABLE 12-1. TOTAL TRI RELEASES AND TRANSFERS FOR THE CHEMICAL AND ALLIED PRODUCTS INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL TRI RELEASES/ TRANSFERS	
		Pounds	Percent
28-	Chemicals & Allied Products - General	17,175,923	0.14
281	Industrial Inorganic Chemicals	1,722,789,318	14.25
282	Plastics & Synthetic Organics	533,077,745	4.41
283	Pharmaceutical & Biological Products	563,751,841	4.66
284	Soaps, Cleansers, Cosmetics	20,246,433	0.17
285	Paints	70,359,051	0.58
286	Industrial Organic Chemicals	938,658,593	7.76
287	Pesticides & Agricultural Chemicals	453,220,589	3.75
289	Printing Inks, Explosives & Other	5,317,647,271	43.99
	Multiple SIC codes within SIC 28	2,451,902,907	20.28
TOTAL RELEASES AND TRANSFERS		12,088,829,671	100.00

The Printing Inks, and Explosives and the Industrial Organic Chemical industries reported the largest TRI releases and transfers from the Chemicals Industry.

When the facilities in the Chemical industry are broken down into their 3-digit SIC code classifications, the Printing Inks and Explosives industry segment represents 44 percent (5.3 billion pounds) of all releases and transfers from the Chemical industry in 1987 (Table 12-1). This was because of the large release of over 5.2 billion pounds from a single facility in California. The segment of the Chemical industry with the second largest amount of releases and transfers was Industrial Inorganic Chemicals with 14 percent (1.7 billion pounds) of the TRI releases and transfers from facilities in the Chemical industry. For the Industrial Inorganic Chemicals industry, further analysis shows that 39 percent (668 million pounds) of its releases and transfers were on-site land releases while 29 percent (501 million pounds) were releases to surface waters (Figure 12-1).

For the Primary Metals industry, the industry segments that reported the most TRI releases and transfers were the Blast Furnaces and Basic Steel Products industry (34 percent or 886 million pounds) and the Primary Nonferrous Metals industry (879 million pounds or 33.9 percent) which reported about the same amount (Table 12-2). A further breakdown of releases and transfers for the Blast Furnaces

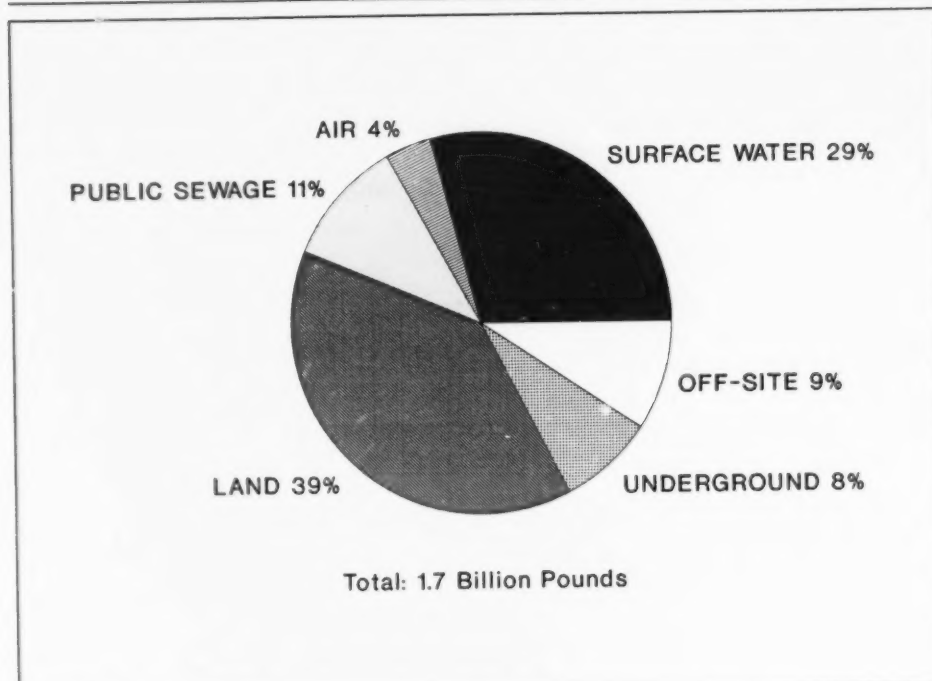


Figure 12-1.
Inorganic Chemical Industry (SIC 281) Total TRI Releases and Transfers, 1987.

and Basic Steel Products industry shows that 68 percent (606 million pounds) were off-site transfers (not including transfers to public sewage systems) and another 16 percent (143 million pounds) were on-site land releases (Figure 12-2). Only 11 percent (99 million pounds) of TRI releases and transfers by the Blast Furnaces and Basic Steel Products industry were direct releases to air and surface waters; this was small compared to the pattern of releases from the TRI facilities as a whole, which represented 54 percent (12.2 billion pounds) of the total TRI releases to air and surface waters.

Other analyses of TRI data could focus even more precisely on specific industries at the 4-digit SIC code level.

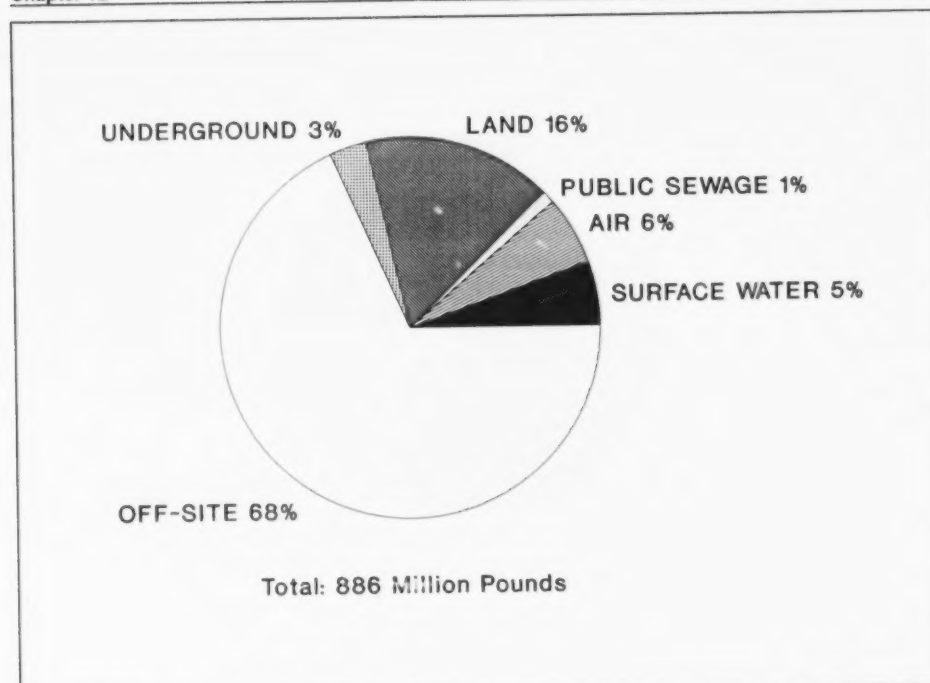


Figure 12-2.
Blast Furnaces and Basic Steel Products Industry (SIC 331), TRI Releases and Transfers, 1987.

TABLE 12-2. TRI RELEASES AND TRANSFERS FOR
THE PRIMARY METALS INDUSTRY, 1987

SIC CODE INDUSTRY	TOTAL TRI RELEASES/ TRANSFERS	
	Pounds	Percent
33- Primary Metals - General	44,865,775	1.73
331 Blast Furnaces & Basic Steel Products	886,117,579	34.17
332 Iron & Steel Foundries	61,182,139	2.36
333 Primary Nonferrous Metals	879,236,251	33.90
334 Secondary Nonferrous Metals	457,017,572	17.62
335 Rolling & Drawing of Nonferrous Metals	89,628,998	3.46
336 Nonferrous Foundries (Casting)	17,269,421	0.67
339 Primary Metal Products & Other	51,518,309	1.99
Multiple SIC codes within SIC 33	106,401,997	4.10
TOTAL	2,593,238,041	100.00

Parent Companies and Their Facilities

One corporation may be the parent company for several facilities that reported in the TRI database. General Motors Corporation had the most number of facilities (145) that reported to TRI for 1987. While 37 percent (54 facilities) of its facilities that reported were located in Michigan and 14 percent (21 facilities) were in Ohio, it had facilities in 20 other states across the United States that reported to TRI (Table 12-3).

General Motors Corporation reported the largest number of facilities to TRI.

The types of releases and transfers from this group of General Motors Corporation facilities differed somewhat from the group of all TRI facilities. Releases to air accounted for 49 percent (70 million pounds) of all TRI releases and transfers from these facilities whereas for all TRI facilities releases to air were 12 percent of the total (Figure 12-3). The General Motors Corporation facilities reported relatively few discharges to surface waters (one percent or 1.5 million pounds) while this was the largest category for TRI facilities taken as a whole.

The types of chemicals used at the General Motors Corporation facilities also differed from the group of all TRI facilities. For General Motors Corporation facilities, releases and transfers of solvents such as xylene, toluene and methyl ethyl ketone were reported in the largest

TABLE 12-3. NUMBER OF GENERAL MOTORS CORPORATION FACILITIES WITH TRI FORMS PER STATE, 1987

STATE	TRI FACILITIES		STATE	TRI FACILITIES	
	Number	Percent		Number	Percent
Alabama	2	1.38	Maryland	2	1.38
California	14	9.66	Michigan	54	37.24
Connecticut	1	0.69	Mississippi	1	0.69
Delaware	1	0.69	Missouri	3	2.07
Florida	1	0.69	New Jersey	3	2.07
Georgia	4	2.76	New York	10	6.90
Illinois	2	1.38	Ohio	21	14.48
Indiana	14	9.66	Oklahoma	1	0.69
Iowa	1	0.69	Texas	2	1.38
Kansas	3	2.07	Wisconsin	3	2.07
Kentucky	1	0.69	TOTAL	145	100.00
Louisiana	1	0.69			

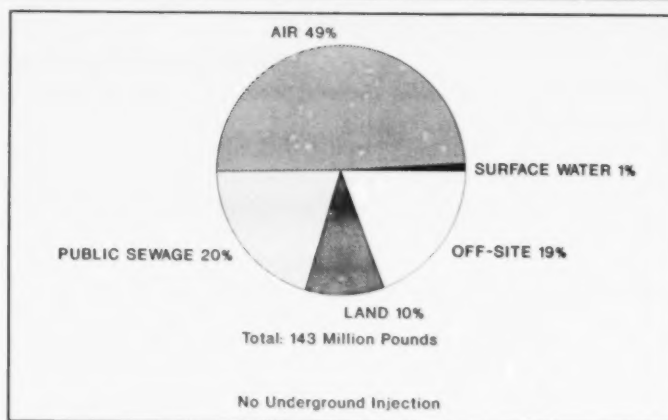


Figure 12-3.
General Motors Corporation Facilities, TRI Releases and Transfers, 1987.

TABLE 12-4. THE 25 TRI CHEMICALS WITH THE LARGEST TOTAL RELEASES AND TRANSFERS FROM GENERAL MOTORS FACILITIES, 1987

CHEMICAL NAME	TRI TOTAL RELEASES/ TRANSFERS	
	Pounds	Percent
XYLENE (MIXED ISOMERS)	19,954,651	13.95
TOLUENE	16,119,010	11.27
METHYL ETHYL KETONE	15,583,430	10.89
SODIUM HYDROXIDE (SOLUTION)	14,520,512	10.15
ALUMINUM OXIDE	14,284,350	9.96
SULFURIC ACID	7,262,866	5.08
HYDROCHLORIC ACID	5,852,999	4.09
ACETONE	5,561,031	3.89
GLYCOL ETHERS	5,129,912	3.59
SODIUM SULFATE (SOLUTION)	4,645,264	3.25
1,1,1-TRICHLOROETHANE	4,359,174	3.05
N-BUTYL ALCOHOL	3,375,135	2.36
DICHLOROMETHANE	2,712,724	1.90
METHANOL	2,670,005	1.87
TETRACHLOROETHYLENE	2,661,913	1.86
FREON 113	2,284,624	1.60
TRICHLOROETHYLENE	1,460,084	1.02
ETHYLENE GLYCOL	1,341,689	0.94
CHROMIUM COMPOUNDS	1,034,520	0.72
PHOSPHORIC ACID	868,880	0.61
URETHANE	847,750	0.59
FORMALDEHYDE	768,040	0.54
BARIUM COMPOUNDS	704,085	0.49
NICKEL	676,641	0.47
MANGANESE	656,063	0.46
SUBTOTAL	135,335,352	94.59
TOTAL FOR ALL OTHERS	7,735,729	5.41
GRAND TOTAL	143,071,081	100.00

mounts. These three chemicals represented 36 percent (52 million pounds) of all releases and transfers reported by these facilities (Table 12-4). Because solvents can be highly volatile, the use of these chemicals could in part explain the relatively larger releases to air.

TRI Chemical Exports

An analysis of TRI chemical exports yields a different, more international overview of the manufacture and disposal of TRI chemicals than the national analyses presented in earlier chapters. The off-site transfer location data in the TRI database (which were analyzed in

Chapter 9 of this report) can be searched according to geographical names other than states. For example, the export of TRI chemical wastes from the United States could be examined.

For 1987, TRI facilities identified 13 different sites outside of the country to which U.S. facilities transferred 6.4 million pounds of chemical wastes, approximately 0.03 percent of the total reported releases and transfers for 1987 (Table 12-5). Canadian sites received the largest amounts of exported TRI chemical wastes. The remainder of the exported TRI chemical wastes were sent to sites in Europe (in Belgium, Spain, and the United Kingdom). Metals and metal containing compounds represented 65 percent (4.2 million pounds) of all TRI exports (Figure 12-4), although some of this material may have been sent overseas for recycling, rather than for treatment and disposal. Exports of just the metal copper represented 16 percent (1.1 million pounds) of all reported exports (Table 12-6). The RCRA identification numbers of the transferring sites, when given, show that most of the transfers to Canada originated from facilities in Michigan and New York. (The first two letters in the RCRA number abbreviate the state name.)

Facilities reported exports of 6 million pounds of TRI chemical wastes to Canada, Belgium, Spain, and the United Kingdom in 1987.

TABLE 12-5. EXPORTS - TRI OFF-SITE TRANSFERS TO SITES NOT IN THE UNITED STATES, 1987

TRANSFER SITE NAME	TRANSFER SITE CITY, COUNTRY	TRI OFF-SITE TRANSFER	
		Pounds	Percent
STABLEX CANADA	BLAINVILLE, QUEBEC, CANADA	4,000,188	62.05
TRICIL (SARNIA) LTD.	SARNIA, ONTARIO, CANADA	1,805,886	28.01
CAPPER PASS & SONS LTD	NORTH HUMBERSIDE, UNITED KINGDOM	355,026	5.51
MEGA METALS LTD.	VANCOUVER, BRITISH COLUMBIA, CANADA	215,000	3.34
METALLURGIE HOBOKEN-OVERPELT	HOBOKEN, BELGIUM	27,000	0.42
METALLURGIE HOBOKEN-OVERPELT	ANTWERP, BELGIUM	10,850	0.17
WATH ALUMINUM	WATH OF DEORNE, UNITED KINGDOM	17,500	0.27
NORAND MINES HORNE DIV.	QUEBEC, CANADA	8,100	0.13
ANACHEMIA CANADA, INC.	VILLE ST. PIERRE, CANADA	3,200	0.05
THOR CHEMICALS, S.A. (PTY) LTD.	CATO RIDGE, SPAIN	2,333	0.04
MINAS DE ALMADEN Y ARRAYNES	MADRID, SPAIN	1,500	0.02
GALLANT ENTERPRISES LIMITED	EDMUNDSTON, BRITISH COLUMBIA, CANADA	140	0.00
QUANTEX CHEMICAL INC.	KITCHENER, ONTARIO, CANADA	5	0.00
TOTAL		6,446,728	100.00

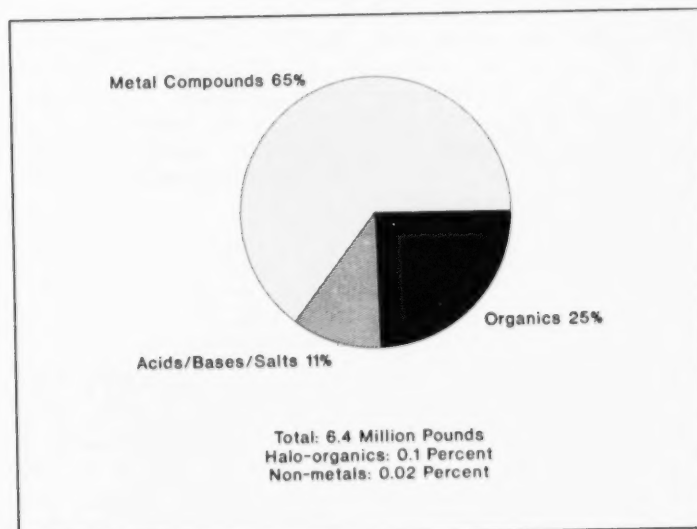
Figure 12-4.
TRI Chemicals Exported by Chemical Class, 1987.

TABLE 12-6. TRI OFF-SITE TRANSFERS TO FOREIGN COUNTRIES
FOR THE 25 CHEMICALS WITH THE LARGEST EXPORTS, 1987

CHEMICAL NAME	TOTAL EXPORTS	
	Pounds	Percent
1 COPPER	1,063,539	16.50
2 LEAD	689,186	10.69
3 CHROMIUM COMPOUNDS	620,850	9.63
4 NICKEL COMPOUNDS	543,553	8.43
5 METHANOL	402,220	6.24
6 TOLUENE	339,014	5.26
7 COPPER COMPOUNDS	334,590	5.19
8 SODIUM HYDROXIDE (SOLUTION)	329,688	5.11
9 NICKEL	327,023	5.07
10 XYLENE (MIXED ISOMERS)	231,510	3.59
11 PHENOL	157,060	2.44
12 ZINC (FUME OR DUST)	153,864	2.39
13 ZINC COMPOUNDS	149,833	2.32
14 CHROMIUM	144,885	2.25
15 SODIUM SULFATE (SOLUTION)	113,940	1.77
16 CYANIDE COMPOUNDS	103,439	1.60
17 GLYCOL ETHERS	96,250	1.49
18 HYDROCHLORIC ACID	91,750	1.42
19 ACETONE	88,993	1.38
20 METHYL ETHYL KETONE	88,670	1.38
21 ALUMINUM OXIDE	72,740	1.13
22 METHYL ISOBUTYL KETONE	69,640	1.08
23 CUMENE	36,500	0.57
24 SULFURIC ACID	33,800	0.52
25 N-BUTYL ALCOHOL	24,804	0.38
SUBTOTAL	6,307,341	97.84
TOTAL FOR ALL OTHERS	139,387	2.16
GRAND TOTAL	6,446,728	100.00

Chemical Analyses

Previous chapters examined the top 25 TRI chemicals by amount of releases and transfers to different segments of the environment (air, water, land), as well as analyzing releases and transfers of chemicals grouped into six classes (see Chapter 4) by chemical structure. Chemicals can be classified and analyzed in other ways, however, such as by similar uses (such as pesticides or dyes), similar properties (such as toxicity or environmental fate), statutory or regulatory requirements, or other interests.

Pesticides

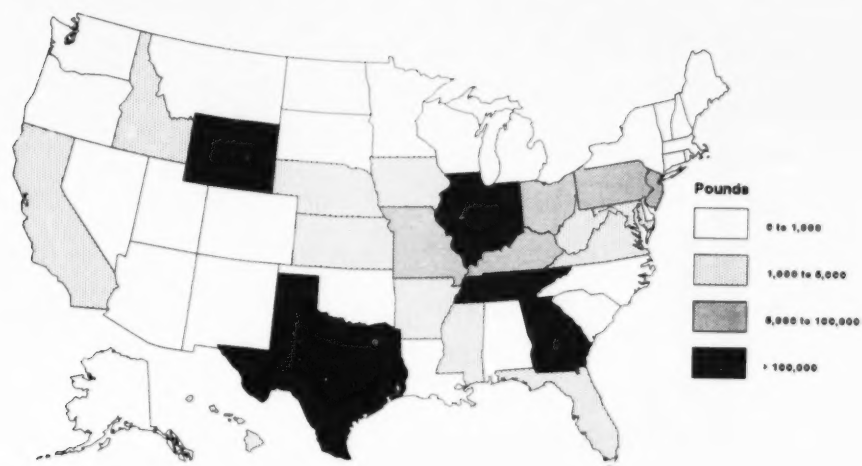
Manufacturing facilities reported releases and transfers of 3.1 million pounds of pesticides in 1987.

Facilities manufacturing agricultural chemicals, such as certain pesticides, are required to report under TRI. TRI data for 20 major pesticides show that manufacturing facilities reported releases and transfers of 3 million pounds of these pesticides for 1987 (Table 12-7). Facilities in six states released or transferred over 100,000 pounds of pesticides in 1987 (Map 12-1).¹ Georgia facilities released 1.4 million pounds of pesticides—by far the largest amount—followed by Texas with 900,000 pounds (Figure 12-5).

Facilities in the Chemical and Allied Products industry, which includes as a subcategory Pesticides and Agricultural Chemicals, released or transferred 3.1 million pounds of pesticides, or 98 percent of the total pesticide releases and transfers reported to TRI for 1987 (Figure 12-6). Within the Chemical industry, the Pesticides and Agricultural Chemicals sector released 1.5 million pounds of pesticides (49 percent of the Chemical industry's total); the only other sectors with releases and transfers over 100,000 pounds were Pharmaceutical and Biological Products and Printing Inks, Explosives, and Other (Table 12-8).

Nearly half of all TRI pesticide releases and transfers were associated with processing the chemicals, while another 36 percent of the releases and transfers came from manufacturing activities (Figure 12-7). Further analyses of activities and uses for reporters of pesticides could determine why this might be. For example, the manufacturing

¹ Remember, however, that releases and transfers associated with manufacturing and processing are probably minor sources of pesticides released to the environment. Rather, use by farmers and other consumers—not covered by TRI reporting requirements—probably account for the most significant amounts of pesticides released to the environment.



Map 12-1.
Total Releases and Transfers of Pesticides Reported to TRI, 1987.

TABLE 12-7. TOTAL TRI RELEASES AND TRANSFERS OF
MAJOR PESTICIDES, 1987

Rank	CHEMICAL NAME	TOTAL TRI RELEASES/ TRANSFERS	
		Pounds	Percent
133	CHLOROTHALONIL	873,031	27.77
158	CARBARYL	478,860	15.23
183	ZINEB	417,948	13.29
184	CAPTAN	307,444	12.84
187	PARYATHION	351,387	11.18
176	CHLORDANE	250,173	7.98
188	TRIFLURALIN	130,358	4.43
191	HEPTACHLOR	120,305	3.83
205	MANEB	57,192	1.82
223	FLUOMETURON	17,687	0.58
230	TRICHLORFON	11,448	0.38
233	DICHLORVOS	9,308	0.30
235	LINDANE	8,981	0.29
242	CHLORAMBEN	4,509	0.14
248	CUPFERRON	2,803	0.09
249	DACOFOL	1,840	0.06
257	PROPOXUR	752	0.02
263	METHOXYCHLOR	504	0.02
267	CHLOROBENZILATE	269	0.01
273	NITROGEN MUSTARD	0	0.00
TOTAL		3,143,885	100.00

PESTICIDES ON THE TRI LIST BUT WITH NO REPORTS, 1987

ALDRIN
DALLATE
NITROFEN
TOXAPHENE
THIAZOXONE

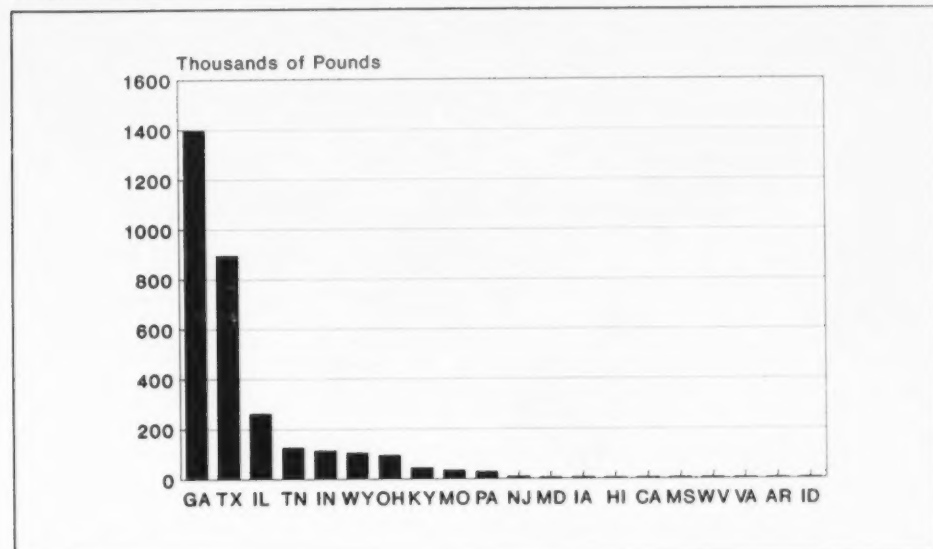


Figure 12-5.
The 20 States with the Largest Releases and Transfers of TRI Pesticides, 1987.

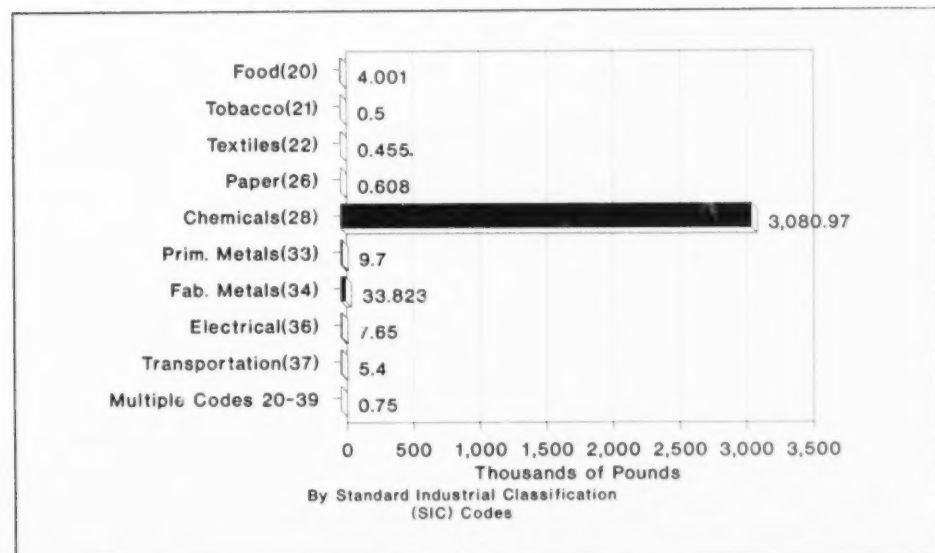


Figure 12-6.
Total Releases and Transfers for TRI Pesticides by Industry, 1987.

TABLE 12-8. TOTAL TRI RELEASES AND TRANSFERS OF PESTICIDES
BY THE CHEMICAL AND ALLIED PRODUCTS INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL TRI RELEASES/ TRANSFERS	
		Pounds	Percent
28	Chemicals & Allied Products - General	0	0.00
281	Industrial Inorganic Chemicals	0	0.00
282	Plastics & Synthetic Organics	0	0.00
283	Pharmaceutical & Biological Products	178,000	5.68
284	Soaps, Cleaners, Cosmetics	4	0.00
285	Paints	0	0.00
286	Industrial Organic Chemicals	1,117	0.04
287	Pesticides & Agricultural Chemicals	1,540,479	49.00
288	Printing Inks, Explosives & Other	104,431	3.32
SUBTOTAL		1,824,033	58.02
Multiple 3-digits in 28 SIC code		1,256,945	39.98
In 20-27 or 29-39 SIC codes		62,687	2.00
Not in 20-39 SIC codes		0	0.00
GRAND TOTAL		3,143,865	100.00

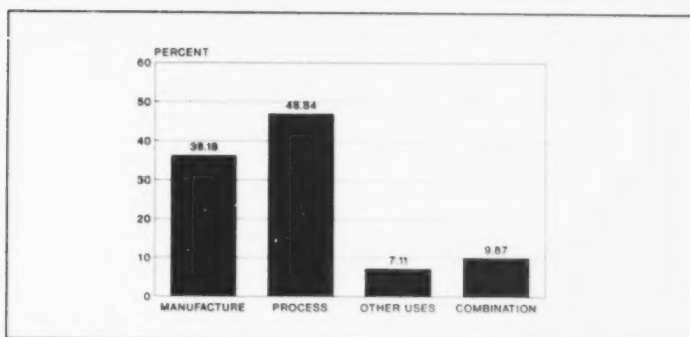


Figure 12-7.
Total Releases and Transfers for TRI Pesticides by Activities and Uses, 1987.

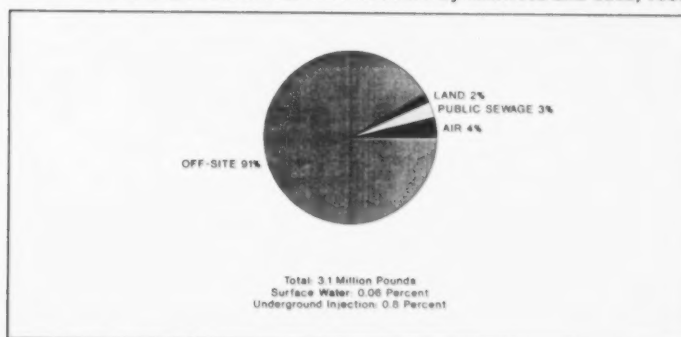


Figure 12-8.
Releases and Transfers for TRI Pesticides, 1987.

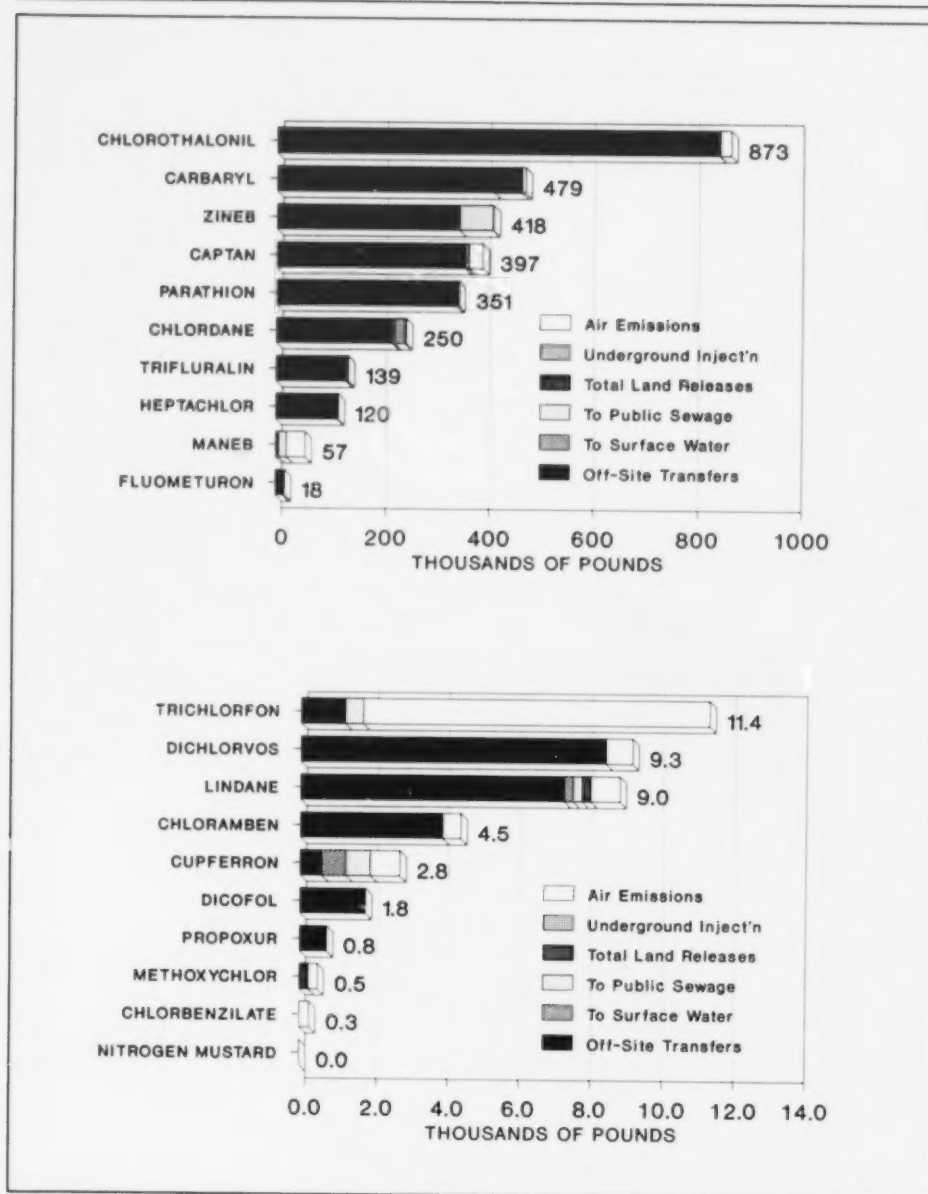


Figure 12-9.
Total Releases and Transfers by Media for TRI Pesticides, 1987.

category is further divided into six different types and the processing category is divided into four types. These subcategories could be looked at for more specific uses of the chemicals. Then, the uses could be identified with particular facilities or areas of the country to see if there was an underlying pattern to the releases and transfers.

Over ninety percent of the total pesticide releases and transfers reported to TRI were not direct releases to the environment, but off-site transfers (Figure 12-8). Air emissions and discharges to public sewage systems accounted for much of the remainder. Some individual pesticides were distributed in different proportions: Maneb was released primarily to air and to public sewage systems, and Trichlorfon was released almost entirely to air (Figure 12-9).

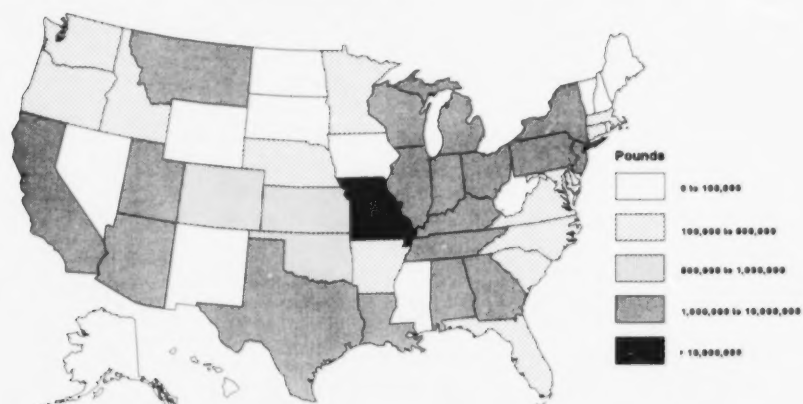
Lead and Lead Compounds.

Releases of lead are regulated under several different environmental statutes affecting releases to all segments of the environment. Lead is both a priority water pollutant and a hazardous air pollutant; it has been banned as an additive in gasoline; and some lead compounds are listed under the RCRA statutes. Because lead is a hazard in all of the various segments of the environment the TRI database is particularly helpful in determining the extent to which lead was released to the environment. TRI facilities reported releases and transfers of 81 million pounds of lead and lead compounds in 1987 (Table 12-9).²

TABLE 12-9 TOTAL TRI RELEASES AND TRANSFERS FOR LEAD
AND LEAD COMPOUNDS, 1987

LEAD	50,774,634 POUNDS
LEAD COMPOUNDS	30,019,072 POUNDS
TOTAL RELEASES AND TRANSFERS FOR LEAD	80,793,706 POUNDS

2 "Lead" and "lead compounds" are separately listed under TRI. This analysis combines data from all forms that reported "lead" or "lead compounds."



Map 12-2.
Total Releases and Transfers of Lead and Lead Compounds Reported to TRI, 1987.

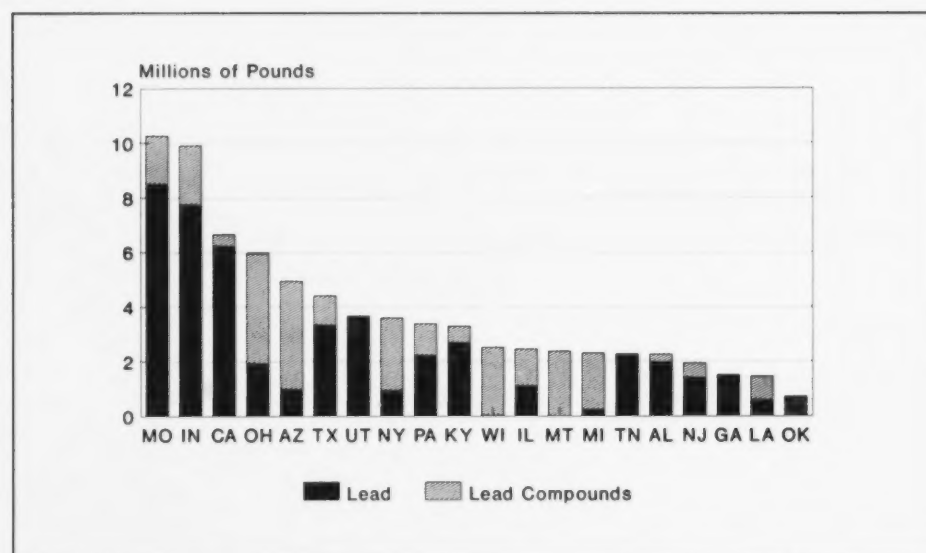


Figure 12-10.
The 20 States with the Largest TRI Releases and Transfers for Lead and Lead Compounds, 1987.

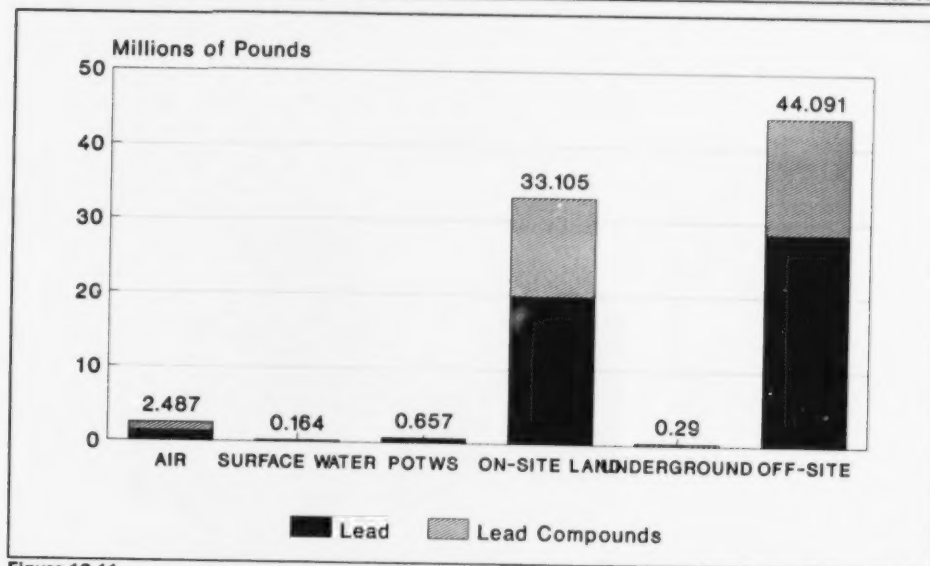


Figure 12-11.
TRI Releases and Transfers for Lead and Lead Compounds by Media, 1987.

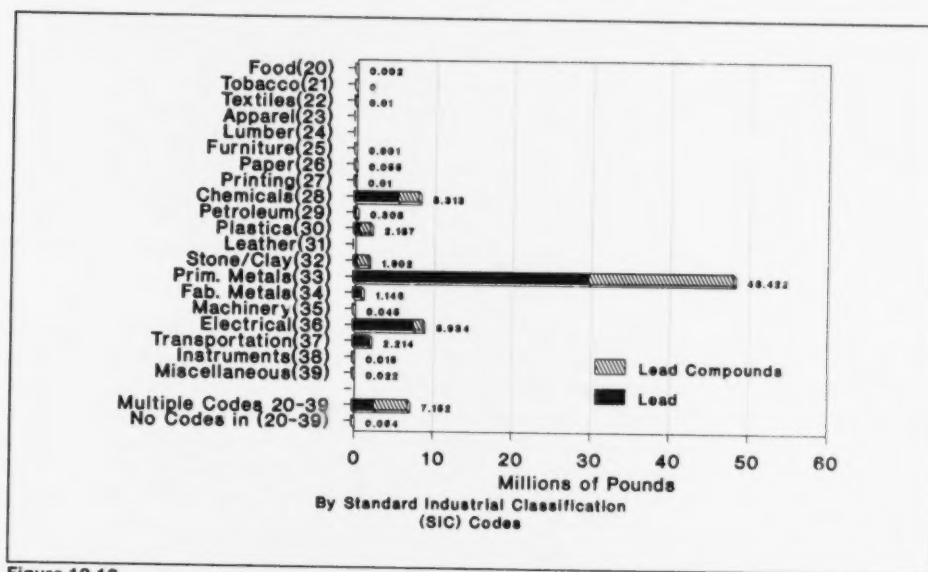


Figure 12-12.
Total TRI Releases and Transfers for Lead and Lead Compounds by Industry, 1987.

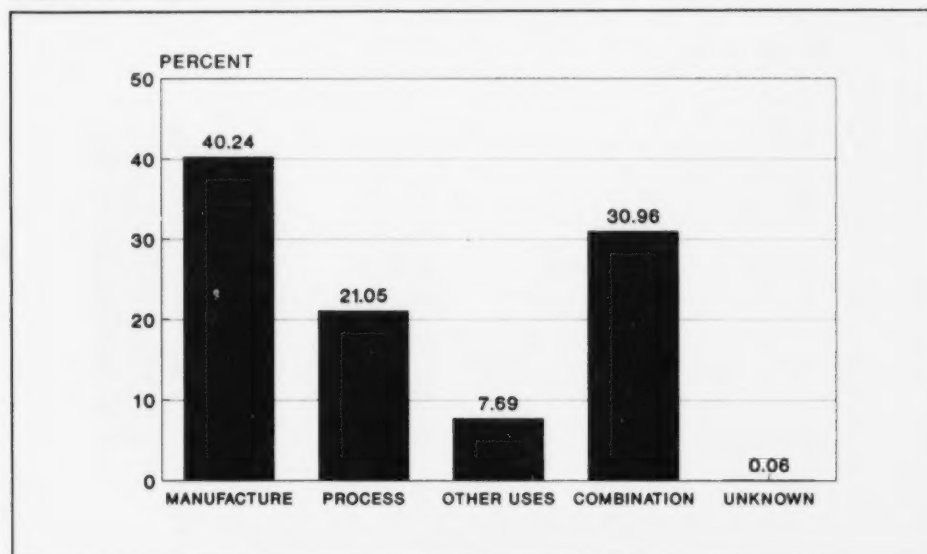


Figure 12-13.
Total TRI Releases of Lead and Lead Compounds by Industrial Activities and Uses, 1987.

Facilities reported releases and transfers of 81 million pounds of lead and lead compounds in 1987.

Releases and transfers of lead and lead compounds were scattered throughout all parts of the country (Map 12-2); Missouri facilities reported the largest releases and transfers with over ten million pounds (Figure 12-10). Over half (44 million pounds) of the total amount of lead and lead compounds was transferred off-site rather than released directly to the environment; another 41 percent (33 million pounds) was released on-site to land (Figure 12-11). Air emissions of lead and lead compounds amounted to 2.5 million pounds, or three percent of the total releases and transfers of lead and lead compounds.

Facilities in the Primary Metals industry released and transferred the largest share of lead and lead compounds (60 percent), followed by facilities in the Electrical Products and Chemical industries (11 percent and 10 percent, respectively) (Figure 12-12). Facilities engaged in *manufacturing only* released and transferred 40 percent of the total amount of lead and lead compounds, while facilities that reported *processing only* released and transferred 21 percent (Figure 12-13).

Regional and State-Level Analyses

TRI data incorporated various geographical data around which to build analyses: state, county, city, zip code, street address, latitude and longitude, off-site locations to which chemical wastes were transferred, and the name(s) of water bodies to which wastewater was discharged. These data can be separated or combined to produce geographical analyses tailored to almost any interest.

Regional Analyses: Major Water Systems

Geographical analyses could focus on releases within a region's major water systems to examine the chemicals that might eventually end up in the water. For example, parts of the states of Pennsylvania, Delaware, Maryland and Virginia are in the drainage basin for the Chesapeake Bay, and the TRI chemical releases and transfers in any of these four states could potentially affect the Bay or the ecosystems it supports. TRI data can be used to locate all TRI facilities within this region by latitude and longitude³ and display their releases and transfers (Map 12-3). As illustrated, the heaviest concentration of TRI releases and transfers are in the area just north of the Bay and in another area to the southwest.

While all releases and transfers of TRI chemicals might affect the Bay region, direct discharges to surface waters may pose a more immediate concern. TRI data can be used to map all discharges of TRI chemicals to surface waters (Map 12-4) that were reported for 1987 in order to investigate the situation in more detail. Such analyses could be further refined to examine discharges of a particular chemical or set of chemicals.

3 Latitude and longitude data were optional for the 1987 reporting year. Over 60 percent of the reporting facilities did provide the information, however, and EPA has supplied the latitude and longitude of the center of the five-digit zip code for all facilities that did not identify their geographical coordinates. All facilities will be required to provide latitude and longitude data starting with the 1988 reporting year.



Map 12-3.
TRI Total Releases and Transfers Around Chesapeake Bay, 1987.

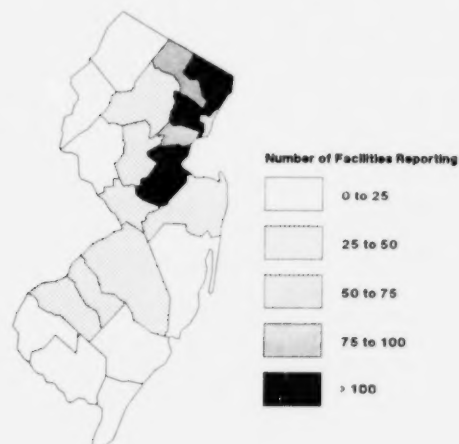


Map 12-4.
TRI Discharges to Surface Water Around Chesapeake Bay, 1987.

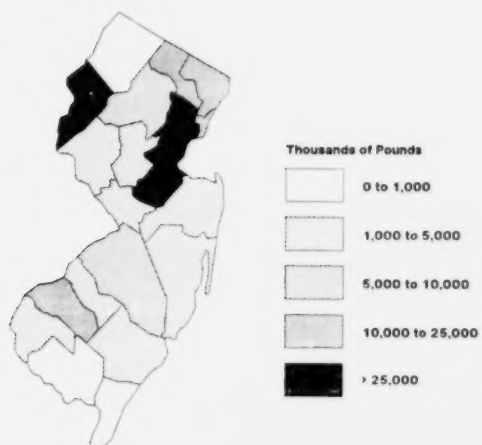
State Analyses: By County or Zip Code Area

Localized analyses of each state offer a more precise perspective of where TRI chemicals are being released. Maps based on counties or zip code regions can detail locations with high concentrations of industrial facilities or large chemical releases.

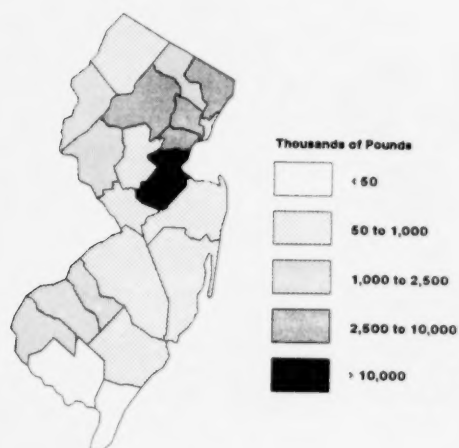
Maps of facilities and total chemical releases and transfers in New Jersey, for example, show the distribution of TRI releases and transfers state-wide in 1987. Comparing the maps shows that while TRI facilities (Map 12-5) were concentrated in the northeastern part of the state, total releases and transfers were also large in parts of northwest New Jersey (Map 12-6). In comparing the different types of releases and transfers, the maps show that air emissions (Map 12-7), off-site transfers (Map 12-8), and transfers to public sewage systems (Map 12-9) were concentrated in central New Jersey while surface water discharges (Map 12-10) and on-site releases to land (Map 12-11) occurred in larger amounts in the southern part of the state.



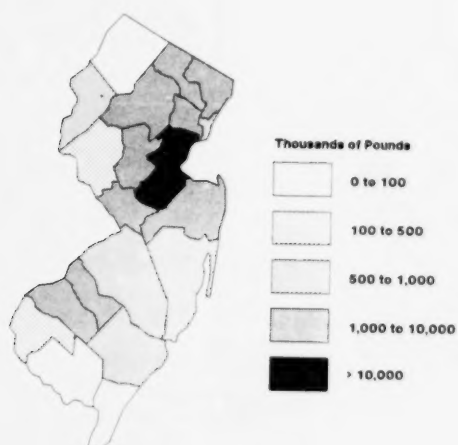
Map 12-5.
New Jersey Facilities Reporting to TRI, 1987.



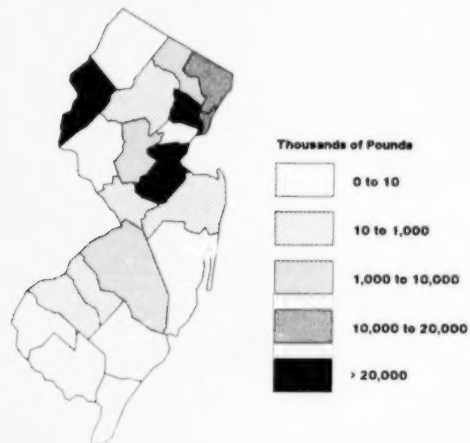
Map 12-6.
Total TRI Releases and Transfers Reported by New Jersey Facilities, 1987.



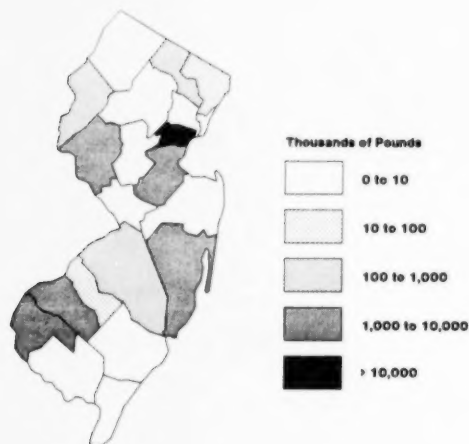
Map 12-7.
TRI Air Emissions Reported by New Jersey Facilities, 1987.



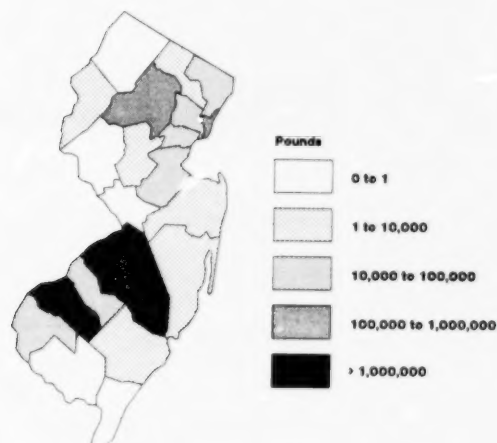
Map 12-8.
TRI Off-site Transfers Reported by New Jersey Facilities, 1987.



Map 12-9.
TRI Transfers to Public Sewage Systems Reported by New Jersey Facilities, 1987.



Map 12-10.
TRI Discharges to Surface Water Reported by New Jersey Facilities, 1987.



Map 12-11.
TRI On-site Land and Underground Injection Releases Reported by New Jersey Facilities, 1987.

Local and Facility-Level Analyses

The local and facility information required by TRI—facility name, street address, city, and zip code—can be used to formulate even more detailed analyses (See Chapter 3 for a complete description of the identifying information facilities must provide to TRI.) A local analysis might be used, for example, to examine the total amounts of chemicals released directly into the environment in a particular city as well as the amounts of off-site transfers transported into the city from other locations. TRI data could be used to determine the amounts of TRI chemicals released to public sewage systems in a particular area. TRI also lends itself to analyses of all or some of the chemicals released at a particular facility. The discussion below illustrates each type of analysis.

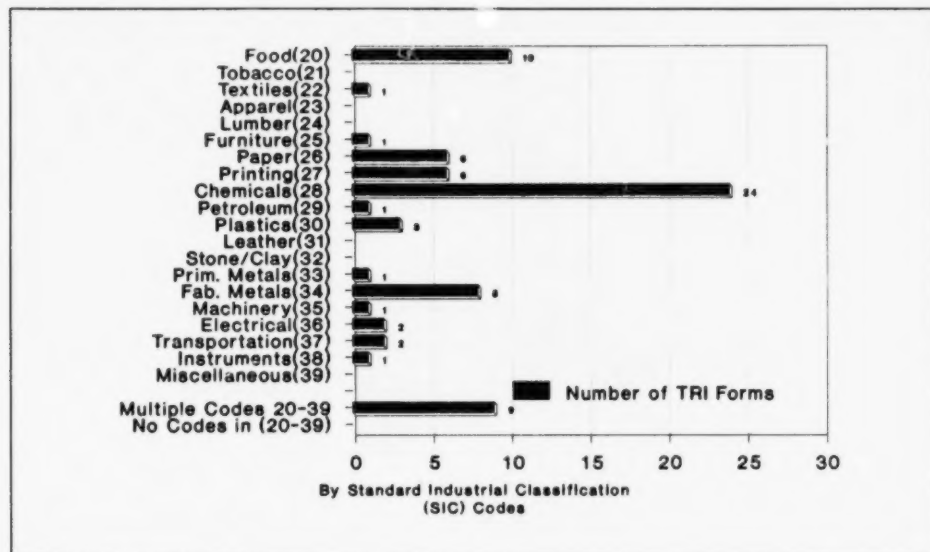


Figure 12-14.
TRI Releases and Transfers by Industry for Memphis, TN, 1987.

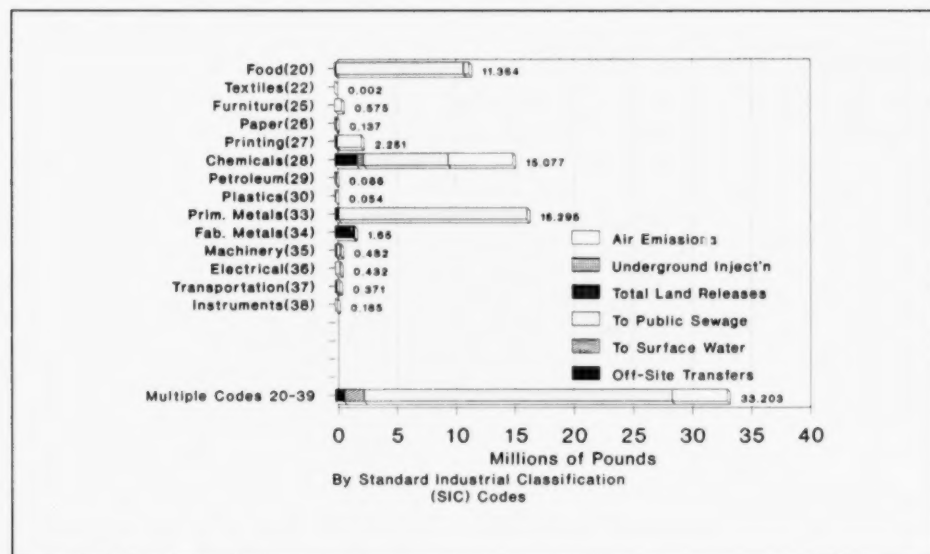


Figure 12-15.
TRI Total Releases and Transfers in Memphis, TN, by Industry, 1987.

Local Analyses: Chemicals Released In and Transferred to Specific Locations (Memphis, TN)

Total releases of TRI chemicals within a city can be studied by summing both the on-site releases of all the facilities located there, as well the off-site transfers from other locations that were accepted by facilities within the city. Such an analysis follows for Memphis, Tennessee.

A total of 76 facilities in Memphis reported releasing or transferring 82 million pounds of TRI chemicals in 1987 (Figures 12-14 and 12-15). The Chemical industry, accounted for more reporting facilities than any other industry (24), but its total TRI releases and transfers of 15 million pounds were less than the total for the Primary Metals industry (eight facilities, 16 million pounds). The nine facilities that listed multiple industries reported the largest total releases and transfers, with 33 million pounds (40 percent).

Facilities in Memphis, TN reported releases and transfers of 82 million pounds of TRI chemicals in 1987.

Facilities discharged 61 million pounds of TRI chemicals to Memphis public sewage systems — accounting for 74 percent of the total amount of chemical releases and transfers reported in Memphis (Figure 12-16). Approximately 14 million pounds of TRI chemicals (17 percent) were emitted to air. Discharges to surface water totalled 2.3 million pounds of TRI chemicals (three percent). Memphis facilities reported releasing fewer than 42,000 pounds of TRI chemicals (less than one percent) on land and by underground injection. Another 4.9 million pounds (six percent) of TRI chemicals were transferred off-site by Memphis facilities.

In an analysis of a particular geographic site such as a city, off-site transfers to sites in the city from facilities located in other areas of the state and in other states can be examined (Figure 12-17). For Memphis, transfers from outside the city totaled 2.2 million pounds. The transfers came largely from out-of-state facilities located as far away as Maine, Illinois and Michigan. In addition, 1.2 million pounds were transferred off-site from facilities located in Memphis to other sites in Memphis. On the other hand, Memphis facilities also reported off-site transfers of 1.3 million pounds to other cities in Tennessee and another 2.4 million pounds to cities outside of Tennessee.

Two million pounds of TRI chemicals were transferred to Memphis from facilities in other cities and states.

Facilities released and transferred 35 million pounds of sodium sulfate in Memphis — more than any other TRI chemical (Table 12-10). Other chemicals released and transferred in large amounts included ammonium sulfate (18 million pounds), ammonia (9 million pounds), methanol (5 million pounds), and toluene (2 million pounds). These five chemicals contributed 85 percent of the total amount of chemicals

Five chemicals accounted for 85 percent of the total amount of chemicals released and transferred in Memphis.

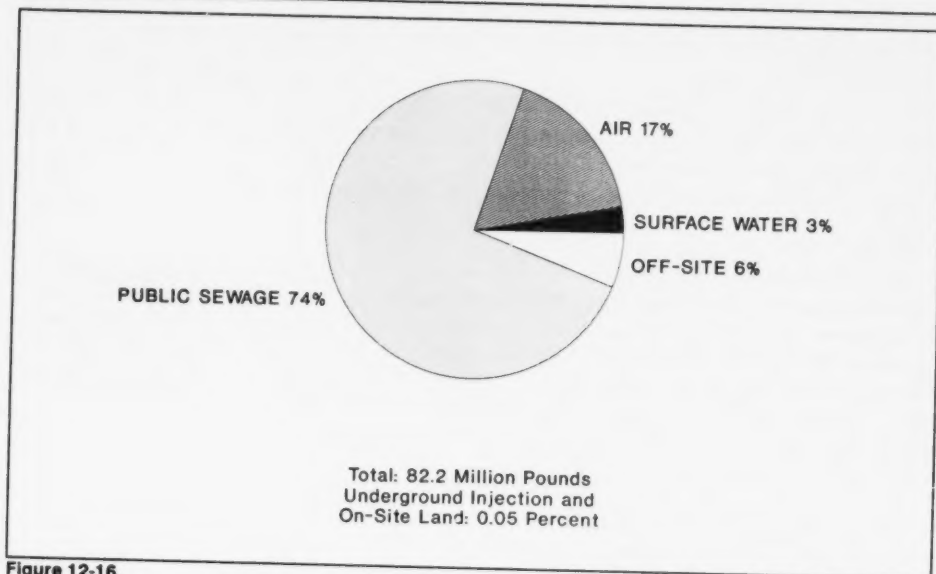


Figure 12-16.
TRI Releases and Transfers by Media for Memphis, TN, 1987.

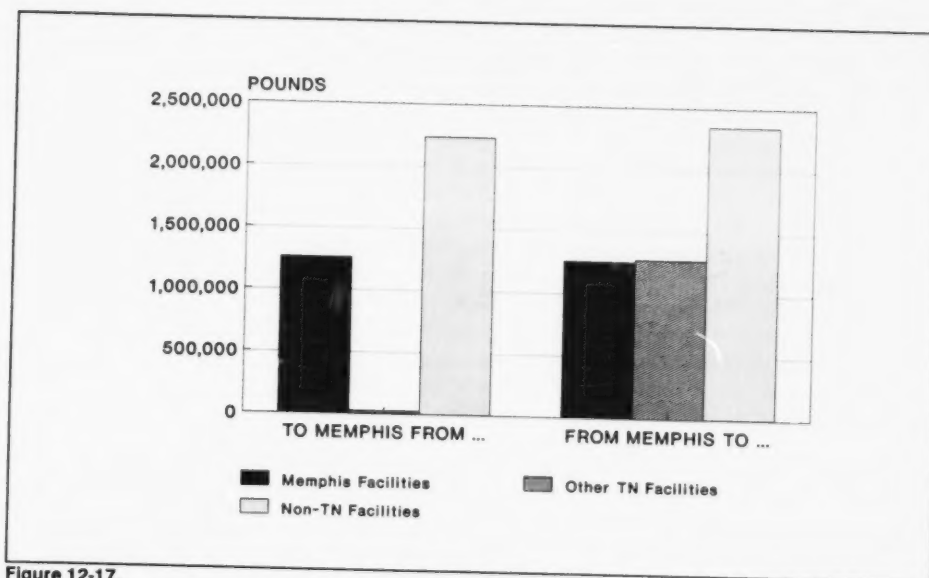


Figure 12-17.
TRI Off-site Transfers to and from Facilities in Memphis, TN, 1987.

released and transferred. Twenty five TRI chemicals accounted for 99 percent of the total TRI releases and transfers in Memphis.

Many of the chemicals that were released in large amounts in Memphis ranked among the top chemicals for total TRI releases and transfers, but there are some striking differences as well: carbon tetrachloride ranked ninth for Memphis (796,799 pounds) but 74th nationwide; barium (713,585 pounds) ranked tenth for Memphis but 63rd overall; HCPD (hexachlorocyclopentadiene) ranked 13th in Memphis but 155th nationwide.

The acids/bases/salts class played a prominent role in Memphis releases and transfers, as they did nationally. (See discussion of chemical classes in Chapter 4.) This class made up 68 percent of the total amounts of chemicals released or transferred in Memphis (Figure 12-18). Chemicals classified as organics (including toluene and methanol) accounted for 14 percent of the total, and nonmetallic inorganics (including ammonia and chlorine) accounted for 11 percent. In all, Memphis facilities reported on 82 of the 328 TRI chemicals and categories.

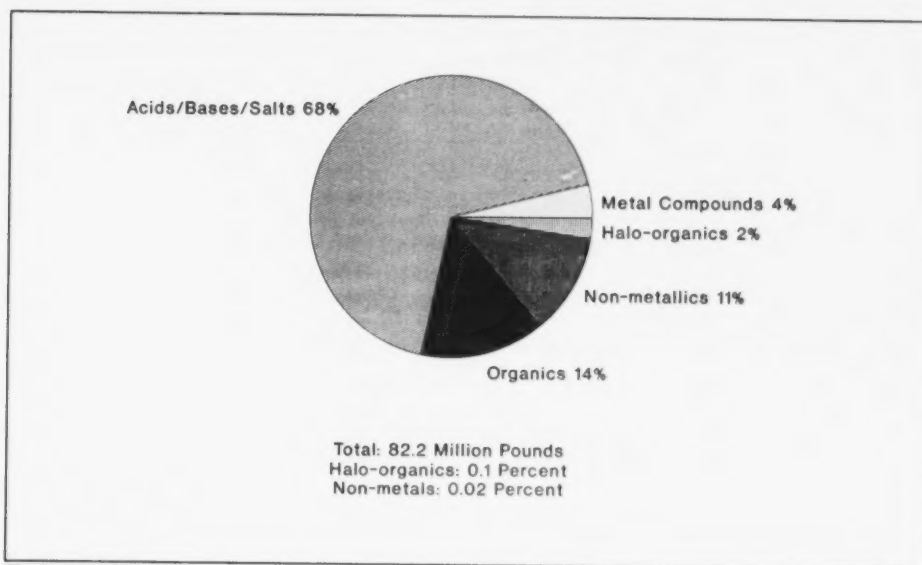


Figure 12-18.
TRI Releases and Transfers by Chemical Class for Memphis, TN, 1987.

TABLE 12-10. THE 25 TRI CHEMICALS WITH THE LARGEST TOTAL RELEASES AND TRANSFERS FOR MEMPHIS, TN, 1987

Rank	CHEMICAL NAME	TOTAL TRI RELEASES/ TRANSFERS	
		Pounds	Percent
1	SODIUM SULFATE (SOLUTION)	35,416,069	43.10
3	AMMONIUM SULFATE (SOLUTION)	17,896,925	21.78
7	AMMONIA	9,318,015	11.34
8	METHANOL	4,944,466	6.02
9	TOLUENE	2,400,196	2.92
6	SODIUM HYDROXIDE (SOLUTION)	2,301,141	2.80
11	ACETONE	2,218,300	2.70
2	ALUMINUM OXIDE	1,407,532	1.71
74	CARBON TETRACHLORIDE	796,799	0.97
63	BARIUM	713,585	0.87
70	METHYL METHACRYLATE	519,494	0.63
53	ISOPROPYL ALCOHOL (MANUFACTURER)	504,984	0.61
155	HEXACHLOROCYCLOPENTADIENE	462,005	0.56
55	NICKEL	439,686	0.54
12	XYLENE (MIXED ISOMERS)	351,433	0.43
14	1,1,1-TRICHLOROETHANE	297,241	0.36
13	METHYL ETHYL KETONE	292,814	0.36
29	LEAD	275,561	0.34
23	ZINC (FUME OR DUST)	193,540	0.24
73	ETHYLENE OXIDE	185,000	0.23
17	DICHLOROMETHANE	169,077	0.21
191	HEPTACHLOR	120,395	0.15
99	DIMETHYL PHTHALATE	102,042	0.12
5	SULFURIC ACID	93,631	0.11
33	METHYL ISOBUTYL KETONE	80,176	0.10
	SUBTOTAL	81,500,107	99.19
	TOTAL FOR ALL OTHERS	666,651	0.81
	GRAND TOTAL	82,166,758	100.00

Local Analyses: Releases to Public Sewage Systems in a Single Metropolitan Area

The above example shows how TRI data can be used to gain an overview of the total amounts of TRI chemicals flowing into and out of a city. The scope of local analyses could be defined in ways other than by city boundaries. For example, TRI data can be used to examine a particular site or system that receives chemical wastes, such as a public sewage system. As described in Chapter 7, TRI requires that facilities identify any public sewage system (known as publicly-owned treatment works, or POTWs) to which they discharged TRI chemicals. For example, the Metropolitan Sanitary District of Greater Chicago, which received one of the largest amounts of TRI chemical discharges in 1987, is analyzed below.⁴

TRI data show that 130 facilities throughout the Chicago metropolitan area submitted 350 TRI forms describing the transfers of 80 TRI chemicals to the treatment plants of the Metropolitan Sanitary District. These facilities reported discharging more than 89 million pounds of TRI chemicals to the sewage system. Nine of the 130 facilities reported discharging more than one million pounds each.

As in the TRI database as a whole (see Chapter 7), the Chemical and Allied Products industry discharged the largest amount of chemicals to the Chicago Metropolitan Sanitary District's plants — a total of 55 million pounds or 62 percent of the total (Table 12-11). Also, the second largest amount (14 million pounds or 16 percent) was from the Food Products industry with the Rubber and Plastics Products industry also transferring over 12 million pounds (14 percent).

Chicago-area facilities discharged six chemicals to the public sewage system in amounts larger than one million pounds each (Table 12-12). Discharges of sodium sulfate dominated the local picture, just as they did on the national level (see Chapters 4 and 7): sodium sulfate accounted for 69 percent of the total discharges (62 of the 89 million pounds)

Over 125 facilities in the Chicago, IL area discharged 80 TRI chemicals to the Chicago Metropolitan Sanitary District Sewage System for a total of 89 million pounds of TRI chemicals in 1987.

Sodium sulfate accounted for 69% of the total TRI discharges to the Chicago public sewage system in 1987.

⁴ Searching TRI for information based on individual names, such as for public sewage treatment plants or systems, is not a trivial task due to the absence of a unique name or identifying number. For example, the Metropolitan Sanitary District of Greater Chicago was reported by facilities under nineteen variations of names or spelling, ranging from initials ("MSD of Greater Chicago") to "Chicago Metropolitan Sanitary District" to "The Metropolitan Sanitary District." Such data analyses require searching and sorting the data in many different ways.

TABLE 12-11. TOTAL TRANSFERS OF TRI CHEMICALS TO THE METROPOLITAN
SANITARY DISTRICT OF GREATER CHICAGO BY INDUSTRY, 1987

SIC CODE	INDUSTRY	TOTAL TRI RELEASES/ TRANSFERS		TOTAL TRI FACILITIES	
		Pounds	Percent	Number	Percent
20	Food Products	13,971,198	15.70	8	8.15
21	Tobacco Manufacturers	0	0.00	0	0.00
22	Tenile Mill Products	80,536	0.10	1	0.77
23	Apparel	0	0.00	0	0.00
24	Lumber and Wood Products	24,000	0.03	1	0.77
25	Furniture and Fixtures	8,750	0.01	2	1.54
26	Paper Products	500	0.00	2	1.54
27	Printing, Publishing	100	0.00	1	0.77
28	Chemical Products	55,088,632	81.89	47	36.15
29	Petroleum Refining	108,250	0.12	3	2.31
30	Rubber and Plastic Products	12,236,150	13.75	1	0.77
31	Leather Products	481,110	0.52	1	0.77
32	Stone, Clay, Glass Products	45,250	0.05	2	1.54
33	Primary Metals	188,127	0.19	12	9.23
34	Fabricated Metals	2,066,588	2.32	34	26.15
35	Machinery, except Electrical	250	0.00	1	0.77
36	Electric and Electronic Equip.	4,709,809	5.29	4	3.08
37	Transportation Equipment	5,450	0.01	4	3.08
38	Measuring, Photographic Goods	3,170	0.00	3	2.31
39	Misc. Manufacturing	0	0.00	0	0.00
	Multiple SIC codes in 20 - 39	17,331	0.02	2	1.54
	No SIC codes in 20 - 39	412	0.00	1	0.77
	TOTAL	88,003,733	100.00	130	100.00

TABLE 12-12. TRI CHEMICALS DISCHARGED TO THE METROPOLITAN
SANITARY DISTRICT OF GREATER CHICAGO IN EXCESS OF
ONE MILLION POUNDS, 1987

CHEMICAL NAME	TOTAL TRI TRANSFERS		TOTAL TRI FORMS	
	Pounds	Percent	Number	Percent
SODIUM SULFATE (SOLUTION)	81,566,718	89.17	17	4.96
SODIUM HYDROXIDE (SOLUTION)	13,797,961	15.50	38	10.86
AMMONIUM SULFATE (SOLUTION)	4,794,000	5.39	3	0.86
SULFURIC ACID	4,380,035	4.92	26	7.43
PHENOL	1,482,960	1.67	8	1.71
HYDROCHLORIC ACID	1,041,080	1.17	19	5.43
SUBTOTAL	87,062,794	97.82	100	31.14
TOTAL FOR ALL OTHERS	1,940,939	2.18	241	68.86
TOTAL	88,003,733	100.00	350	100.00

TABLE 12-13. TRI CHEMICALS DISCHARGED TO THE METROPOLITAN SANITARY
DISTRICT OF GREATER CHICAGO BY CHEMICAL CLASS, 1987

CHEMICAL CLASS	TOTAL TRI TRANSFERS		TOTAL TRI FORMS	
	Pounds	Percent	Number	Percent
Acids/Bases/Salts	83,705,422	96.29	136	38.86
Organics (Non-Halogenated)	29,434,78	3.31	113	32.29
Non-Metallic Inorganics	2,952,49	0.26	9	2.57
Metals and Metal Compounds	108,627	0.12	76	21.71
Halo-organics	865.7	0.01	16	4.57
GRAND TOTAL	88,003,733	100.00	350	100.00

The acids/bases/salts class, as defined in Chapter 4, accounted for 96 percent (86 million pounds) of all TRI chemicals discharged to the Chicago public sewage system analyzed here (Table 12-13). Discharges of 3 million pounds of organics comprised much of the remainder. Discharges of non-metallic inorganics, metals, and halo-organics totalled under 400,000 pounds.

Note that analyses of public sewage systems can be compiled from data reported by facilities discharging to the system, but such analyses cannot be confirmed by TRI data on the amounts of chemicals that the sewage system itself actually received or released. Public sewage systems are not required to report to TRI because they are not generally classified as manufacturing industries.

Facility Analyses: Releases of Trade Secret Chemicals

TRI data can be examined for any individual facility. Even forms claimed as trade secrets yield a considerable amount of information, because only the chemical name itself can be withheld. For example, the Firestone Synthetic Rubber and Latex Company of Orange, Texas, submitted the largest of 40 releases and transfers claimed as trade secrets under TRI. Under TRI provisions regarding trade secrets, it is still possible to locate the following information about the releases and transfers detailed on that form (Table 12-14).

The trade secret chemical in this case (noted as a hydrocarbon) is emitted to the air in the amount of 660,000 pounds as well as transferred off-site in the amount of 11,000 pounds. The total (671,000 pounds) represents 66 percent of the total releases and transfers of TRI chemicals from this plant. The trade secret chemical is used as a chemical processing aid and the chemical wastestream is treated on-site.

In sum, the 40 trade secret claims, which represent only a fraction of one percent of the total number of TRI forms submitted for 1987, can be used to discover much pertinent information: what facility released the chemical, how much was released and transferred, to what segment of the environment (air, water, or land) and where did releases occur. The only information that cannot be determined is chemical identity.

TABLE 12-14. THE TRI FACILITY WITH THE LARGEST TRADE SECRET RELEASES CLAIMED, 1987

Name:	FIRESTONE SYNTHETIC RUBBER AND LATEX CO.			
Address:	FARM ROAD 1006 ORANGE ORANGE TX 77630			
Parent Company:	FIRESTONE TIRE AND RUBBER COMPANY			
Total Releases:	1,010,700 pounds			
Trade Secret Chemical:	671,000 pounds			
All Others:	339,700 pounds			
Chemical:	HYDROCARBON (C01) (TRADE SECRET)			
Maximum Amount Code:	05			
Sic Code:	2822			
Activity/use Code:	3A			
Waste Min:	0			
ID Numbers:	NPDES TX0002968 RCRA TXD008073538 DUNS 008073538			
Release Type:	Off-site	To: CHEMICAL WASTE MANAGEMENT, CARLYSS LA		
Type of Treatment:	M72			
Release Amount:	11,000			
Type of On-site		Wastestream	Treatment Method	Efficiency
Treatment:		Air	A01	98.00
		Liquid	B31	100.00
Release Type:	Air-Fugitive			
Release Amount:	50,000			
Type of On-site		Wastestream	Treatment Method	Efficiency
Treatment:		Air	A01	98.00
		Liquid	B31	100.00
Release Type:	Air-Point Source			
Release Amount:	610,000			
Type of On-site		Wastestream	Treatment Method	Efficiency
Treatment:		Air	A01	98.00
		Liquid	B31	100.00

Cross-Cutting Analyses: Combining TRI with Data From Other Sources

This report has analyzed *only* the data contained in TRI. Of potential interest for many readers, however, will be the perspectives gained by linking TRI data with information from other sources, such as environmental, commercial, or demographic data bases. TRI data offer the opportunity for a multitude of cross-cutting analyses:

- comparisons by Local Emergency Planning Committees (LEPCs) of TRI release data to other data submitted by specific facilities under other sections of the Emergency Planning and Community Right-to-Know Act. This will allow LEPCs to form a better profile of chemical hazards in the community, for planning for response to potential accidents and for broader consideration of community risk. Specific information available includes notification of the presence of any one of the Extremely Hazardous Substances identified by EPA; accidental release information; and information about inventories of hazardous chemicals
- use by State Emergency Response Commissions and other state entities to document chemical use and releases and transfers in states, regions, watersheds, etc.; trends analyses for hot spots; for enforcement purposes; and other uses
- comparisons of TRI release data to measurements of the concentrations of chemicals found in various locations in the environment in an effort to determine possible relationships between industrial sources and environmental distributions
- comparisons of reported TRI releases to regulatory data, such as permit requirements or standards that limit emissions
- comparisons of TRI releases to population levels or to other socioeconomic information
- checking the accuracy of models that attempt to predict how chemicals are dispersed after they have been released into the environment
- attempts to determine the causes for observed ecological changes

In short, TRI data will be a valuable resource for a wide range of inquiries.

TRI in the Future: Comparative Data Analyses

Next year, data for 1988 will be added to TRI, making possible new types of analyses. With data from two or more years, users will be able to study trends in releases, industrial activities and uses, waste treatment, and waste minimization. TRI data will enable citizens to analyze

trends at the national, regional, state, local, and facility-level. Analysis of trends will offer insights into the effectiveness of major environmental programs and policies affecting TRI chemicals and facilities.

APPENDIXES

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A. The Toxics Release Inventory Reporting Form for 1987

Form Approved OMB No.: 2070-0093
Approval Expires: 01/91
Page 1 of 5

(Important: Type or print; read instructions before completing form.)

U.S. Environmental Protection Agency
EPA TOXIC CHEMICAL RELEASE INVENTORY REPORTING FORM
Section 313, Title III of The Superfund Amendments and Reauthorization Act of 1986

EPA FORM R

PART I. FACILITY IDENTIFICATION INFORMATION

(This space for EPA use only)

1. 1.1 Does this report contain trade secret information?
☐ Yes (Answer 1.2) ☐ No (Do not answer 1.2)

1.2 Is this a sanitized copy?
☐ Yes ☐ No

1.3 Reporting Year

2. CERTIFICATION (Read and sign after completing all sections.)
I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparer of this report.

Name and official title of owner/operator or senior management official:

Signature _____ Date signed _____

3. FACILITY IDENTIFICATION

Facility or Establishment Name _____

Street Address _____

City _____ County _____

State _____ Zip Code _____

Technical Contact _____ Telephone Number (include area code) _____

Public Contact _____ Telephone Number (include area code) _____

a. SIC Code b. _____

Latitude _____ Longitude _____

Dun & Bradstreet Number(s) a. _____ b. _____

EPA Identification Number (RCRA I.D. No.) a. _____ b. _____

NPDES Permit Number(s) a. _____ b. _____

Name of Receiving Stream(s) or Water Body(s) a. _____ b. _____ c. _____

Underground Injection Well Code (UIC) Identification No. _____

4. PARENT COMPANY INFORMATION

Name of Parent Company _____

Parent Company's Dun & Bradstreet No. _____

Where to send completed forms
U.S. Environmental Protection Agency
P.O. Box 70268
Washington, D.C. 20024-0268
ATTN: Toxic Chemical Release Inventory

EPA Form 9350-1 (1-88)

(Important: Type or print; read instructions before completing form.)

Page 2 of 5

(This space for EPA use only.)

EPA FORM R
PART II. OFF-SITE LOCATIONS TO WHICH TOXIC
CHEMICALS ARE TRANSFERRED IN WASTES**1. PUBLICLY OWNED TREATMENT WORKS (POTW)**

Facility Name

Street Address

City

County

State

Zip

2. OTHER OFF-SITE LOCATIONS - Number these locations sequentially on this and any additional page of this form you use.☐ Other off-site location

EPA Identification Number (RCRA ID No.)

Facility Name

Street Address

City

County

State

Zip

Is location under control of reporting facility or parent company?

☐☐

Yes No

☐ Other off-site location

EPA Identification Number (RCRA ID No.)

Facility Name

Street Address

City

County

State

Zip

Is location under control of reporting facility or parent company?

☐☐

Yes No

☐ Other off-site location

EPA Identification Number (RCRA ID No.)

Facility Name

Street Address

City

County

State

Zip

Is location under control of reporting facility or parent company?

☐☐

Yes No

☐ Check if additional pages of Part II are attached

EPA Form 9350-1(1-88)

(Important: Type or print, read instructions before completing form.)

Page 3 of 5

(This space for EPA use only.)

EPA FORM R
PART III. CHEMICAL SPECIFIC INFORMATION

1. CHEMICAL IDENTITY																																																																																															
1.1 ☐ Trade Secret (Provide a generic name in 1.4 below. Attach substantiation form to this submission.)																																																																																															
1.2 CAS # - - (Use leading zeros if CAS number does not fill space provided.)																																																																																															
1.3 Chemical or Chemical Category Name																																																																																															
1.4 Generic Chemical Name (Complete only if 1.1 is checked.)																																																																																															
2. MIXTURE COMPONENT IDENTITY (Do not complete this section if you have completed Section 1.)																																																																																															
2. Generic Chemical Name Provided by Supplier (Limit the name to a maximum of 70 characters (e.g., numbers, letters, spaces, punctuation)).																																																																																															
3. ACTIVITIES AND USES OF THE CHEMICAL AT THE FACILITY (Check all that apply.)																																																																																															
3.1 Manufacture: a. ☐ Produce b. ☐ Import c. ☐ For on-site use/processing																																																																																															
d. ☐ For sale/distribution e. ☐ As a byproduct f. ☐ As an impurity																																																																																															
3.2 Process: a. ☐ As a reactant b. ☐ As a formulation component c. ☐ As an article component																																																																																															
d. ☐ Repackaging only																																																																																															
3.3 Otherwise Used: a. ☐ As a chemical processing aid b. ☐ As a manufacturing aid c. ☐ Ancillary or other use																																																																																															
4. MAXIMUM AMOUNT OF THE CHEMICAL ON SITE AT ANY TIME DURING THE CALENDAR YEAR																																																																																															
(enter code)																																																																																															
5. RELEASES OF THE CHEMICAL TO THE ENVIRONMENT																																																																																															
<table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="2">A. Total Release (lbs/yr)</th> <th>B. Reals of Estimate (enter code)</th> <th></th> </tr> <tr> <th colspan="2"></th> <th colspan="2">A.1 Reporting Ranges</th> <th>A.2 Enter Estimate</th> <th></th> </tr> <tr> <th colspan="2"></th> <th>0</th> <th>1-999</th> <th>1000-999</th> <th></th> </tr> </thead> <tbody> <tr> <td>5.1 Fugitive or non-point air emissions</td> <td>5.1a</td> <td></td> <td></td> <td></td> <td>5.1b ☐</td> </tr> <tr> <td>5.2 Stack or point air emissions</td> <td>5.2a</td> <td></td> <td></td> <td></td> <td>5.2b ☐</td> </tr> <tr> <td>5.3 Discharges to water</td> <td>5.3.1 ☐</td> <td>5.3.1a</td> <td></td> <td></td> <td>5.3.1b ☐</td> <td rowspan="3">C. % From Stormwater 5.3.1c</td> </tr> <tr> <td>(Enter letter code from Part I Section 3.10 for streams(s).)</td> <td>5.3.2 ☐</td> <td>5.3.2a</td> <td></td> <td></td> <td>5.3.2b ☐</td> <td>5.3.2c</td> </tr> <tr> <td></td> <td>5.3.3 ☐</td> <td>5.3.3a</td> <td></td> <td></td> <td>5.3.3b ☐</td> <td>5.3.3c</td> </tr> <tr> <td>5.4 Underground injection</td> <td>5.4a</td> <td></td> <td></td> <td></td> <td>5.4b ☐</td> <td></td> </tr> <tr> <td>5.5 Releases to land</td> <td></td> <td>5.5.1a</td> <td></td> <td></td> <td>5.5.1b ☐</td> <td></td> </tr> <tr> <td>5.5.1 (enter code)</td> <td></td> <td>5.5.2a</td> <td></td> <td></td> <td>5.5.2b ☐</td> <td></td> </tr> <tr> <td>5.5.2 (enter code)</td> <td></td> <td>5.5.3a</td> <td></td> <td></td> <td>5.5.3b ☐</td> <td></td> </tr> <tr> <td>5.5.3 (enter code)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>												A. Total Release (lbs/yr)		B. Reals of Estimate (enter code)				A.1 Reporting Ranges		A.2 Enter Estimate				0	1-999	1000-999		5.1 Fugitive or non-point air emissions	5.1a				5.1b ☐	5.2 Stack or point air emissions	5.2a				5.2b ☐	5.3 Discharges to water	5.3.1 ☐	5.3.1a			5.3.1b ☐	C. % From Stormwater 5.3.1c	(Enter letter code from Part I Section 3.10 for streams(s).)	5.3.2 ☐	5.3.2a			5.3.2b ☐	5.3.2c		5.3.3 ☐	5.3.3a			5.3.3b ☐	5.3.3c	5.4 Underground injection	5.4a				5.4b ☐		5.5 Releases to land		5.5.1a			5.5.1b ☐		5.5.1 (enter code)		5.5.2a			5.5.2b ☐		5.5.2 (enter code)		5.5.3a			5.5.3b ☐		5.5.3 (enter code)						
		A. Total Release (lbs/yr)		B. Reals of Estimate (enter code)																																																																																											
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5.5.1 (enter code)		5.5.2a			5.5.2b ☐																																																																																										
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☐ (Check if additional information is provided on Part IV-Supplemental Information.)																																																																																															

EPA Form 9350-1(1-88)

EPA FORM R, Part III (Continued)

Page 4 of 5

6. TRANSFERS OF THE CHEMICAL IN WASTE TO OFF-SITE LOCATIONS						
You may report transfers of less than 1,000 lbs. by checking ranges under A.1.						
A. Total Transfers (lbs/yr)				B. Basis of Estimate (enter code)	C. Type of Treatment/Disposal (enter code)	
A.1 Reporting Ranges			A.2 Enter Estimate			
D			1-499	500-999		
6.1	Discharge to POTW				6.1b ☐	
6.2	Other off-site location (Enter block number from Part II, Section 2.)	☐			6.2b ☐	6.2c ☐
6.3	Other off-site location (Enter block number from Part II, Section 2.)	☐			6.3b ☐	6.3c ☐
6.4	Other off-site location (Enter block number from Part II, Section 2.)	☐			6.4b ☐	6.4c ☐
☐ (Check if additional information is provided on Part IV-Supplemental Information)						

7. WASTE TREATMENT METHODS AND EFFICIENCY						
A. General Wastestream (enter code)	B. Treatment Method (enter code)	C. Range of Influent Concentration (enter code)	D. Sequential Treatment? (check if applicable)	E. Treatment Efficiency Estimate	F. Based on Operating Data?	
					Yes	No
7.1a ☐	7.1b ☐	7.1c ☐	7.1d ☐	7.1e ☐	%	7.1f ☐
7.2a ☐	7.2b ☐	7.2c ☐	7.2d ☐	7.2e ☐	%	7.2f ☐
7.3a ☐	7.3b ☐	7.3c ☐	7.3d ☐	7.3e ☐	%	7.3f ☐
7.4a ☐	7.4b ☐	7.4c ☐	7.4d ☐	7.4e ☐	%	7.4f ☐
7.5a ☐	7.5b ☐	7.5c ☐	7.5d ☐	7.5e ☐	%	7.5f ☐
7.6a ☐	7.6b ☐	7.6c ☐	7.6d ☐	7.6e ☐	%	7.6f ☐
7.7a ☐	7.7b ☐	7.7c ☐	7.7d ☐	7.7e ☐	%	7.7f ☐
7.8a ☐	7.8b ☐	7.8c ☐	7.8d ☐	7.8e ☐	%	7.8f ☐
7.9a ☐	7.9b ☐	7.9c ☐	7.9d ☐	7.9e ☐	%	7.9f ☐
7.10a ☐	7.10b ☐	7.10c ☐	7.10d ☐	7.10e ☐	%	7.10f ☐
7.11a ☐	7.11b ☐	7.11c ☐	7.11d ☐	7.11e ☐	%	7.11f ☐
7.12a ☐	7.12b ☐	7.12c ☐	7.12d ☐	7.12e ☐	%	7.12f ☐
7.13a ☐	7.13b ☐	7.13c ☐	7.13d ☐	7.13e ☐	%	7.13f ☐
7.14a ☐	7.14b ☐	7.14c ☐	7.14d ☐	7.14e ☐	%	7.14f ☐
☐ (Check if additional information is provided on Part IV-Supplemental Information.)						

8. OPTIONAL INFORMATION ON WASTE MINIMIZATION			
(Indicate actions taken to reduce the amount of the chemical being released from the facility. See the instructions for coded items and an explanation of what information to include.)			
A. Type of modification (enter code)	B. Quantity of the chemical in the wastestream prior to treatment/disposal	C. Index	D. Reason for action (enter code)
☐	Current reporting year (lbs/yr) ☐ Prior year (lbs/yr) ☐ Or percent change ☐	☐	☐

EPA Form 9350-1(1-88)

A. The Toxics Release Inventory Reporting Form for 1987

(Important: Type or print; read instructions before completing form.)

Page 5 of 5

EPA FORM R PART IV. SUPPLEMENTAL INFORMATION Use this section if you need additional space for answers to questions in Parts I and III. Number or letter this information sequentially from prior sections (e.g., D.E. F, or 5.54, 5.55).	(This space for EPA use only.)
--	--------------------------------

ADDITIONAL INFORMATION ON FACILITY IDENTIFICATION (Part I - Section 3)	
3.5	SIC Code
3.7	Dun & Bradstreet Number(s)
3.8	EPA Identification Number(s) RCRA (D. No.)
3.9	NPDES Permit Number(s)
3.10	Name of Receiving Stream(s) or Water Body(s)

ADDITIONAL INFORMATION ON RELEASES TO LAND (Part III - Section 5.5)				
Releases to Land	A. Total Release (lbs/yr)			B. Basis of Estimate (enter code)
	A.1 Reporting Ranges			
	0	1-499	500-999	
5.5___ (enter code)	5.5___a			5.5___b ☐
5.5___ (enter code)	5.5___a			5.5___b ☐
5.5___ (enter code)	5.5___a			5.5___b ☐

ADDITIONAL INFORMATION ON OFF-SITE TRANSFER (Part III - Section 6)					
Releases to Land	A. Total Transfer (lbs/yr)			B. Basis of Estimate (enter code)	C. Type of Treatment/Disposal (enter code)
	A.1 Reporting Ranges				
	0	1-499	500-999		
6___ Discharge to POTW	6___a			6___b ☐	
6___ Other off-site location (Enter block number from Part I, Section 2.)	6___a			6___b ☐	6___c. ☐
6___ Other off-site location (Enter block number from Part I, Section 2.)	6___a			6___b ☐	6___c. ☐

ADDITIONAL INFORMATION ON WASTE TREATMENT (Part III - Section 7)					
A. General Wastestream (enter code)	B. Treatment Method (enter code)	C. Range of Influent Concentration (enter code)	D. Sequential Treatment? (check if applicable)	E. Treatment Efficiency Estimate	F. Based on Operating Data? Yes No
7___a ☐	7___b ☐	7___c ☐	7___d ☐	7___e %	7___f ☐
7___a ☐	7___b ☐	7___c ☐	7___d ☐	7___e %	7___f ☐
7___a ☐	7___b ☐	7___c ☐	7___d ☐	7___e %	7___f ☐
7___a ☐	7___b ☐	7___c ☐	7___d ☐	7___e %	7___f ☐
7___a ☐	7___b ☐	7___c ☐	7___d ☐	7___e %	7___f ☐

EPA Form 9350-1(1-88)

B. The TRI List Of Chemicals for 1987 Reporting

SECTION 313 TOXIC CHEMICAL LIST (Including Chemical Categories)

[Note: Chemicals may be added or deleted to the list. The Emergency Planning and Community Right-to-Know Hotline, (800) 635-0202 or (202) 479-2449 in Washington, D.C. or Alaska, will provide up-to-date information on the status of these changes.]

a. Alphabetical List (Effective Date January 1, 1987)

CAS Number	Chemical Name		
75-07-0	Acetaldehyde	4680-78-8	C.I. Acid Green 3
60-35-5	Acetamide	569-64-2	C.I. Basic Green 4
67-64-1	Acetone	989-38-8	C.I. Basic Red 1
75-05-8	Acetonitrile	1937-37-7	C.I. Direct Black 38
53-96-3	2-Acetylaminofluorene	2602-46-2	C.I. Direct Blue 6
107-03-8	Acrolein	16071-86-6	C.I. Direct Brown 95
79-06-1	Acrylamide	2832-40-8	C.I. Disperse Yellow 3
79-10-7	Acrylic acid	3761-53-3	C.I. Food Red 5
107-13-1	Acrylonitrile	81-88-9	C.I. Food Red 15
309-00-2	Aldrin [1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a, 5,8,8a-hexahydro-(1.alpha., 4.alpha.,4a.beta.,5.alpha., 8.alpha.,8a.beta.)-]	3118-97-6	C.I. Solvent Orange 7
		97-56-3	C.I. Solvent Yellow 3
		842-07-9	C.I. Solvent Yellow 14
		492-80-8	C.I. Solvent Yellow 34 (Auramine)
		128-66-5	C.I. Vat Yellow 4
107-05-1	Allyl chloride	7440-43-9	Cadmium
7429-90-5	Aluminum (fume or dust)	156-62-7	Calcium cyanamide
1344-28-1	Aluminum oxide	135-06-2	Captan [1H-isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2- [(trichloromethyl)imino]-]
117-79-3	2-Aminanthraquinone		
60-09-3	4-Aminobenzene	63-25-2	Carbaryl [1-Naphthalenol, methylcarbamate]
92-67-1	4-Aminobiphenyl	75-15-0	Carbon disulfide
82-28-0	1-Amino-2-methylantraquinone	56-23-5	Carbon tetrachloride
7664-41-7	Ammonia	463-58-1	Carbonyl sulfide
6484-52-2	Ammonium nitrate (solution)	120-80-9	Catechol
7783-20-2	Ammonium sulfate (solution)	133-90-4	Chloramben [Benzoic acid, 3-amino- 2,5-dichloro-]
62-53-3	Aniline		
90-04-0	o-Anisidine	57-74-9	Chlordane [4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro- 2,3,3a,4,7,7a-hexahydro-]
104-94-9	p-Anisidine		
134-29-2	o-Anisidine hydrochloride	7782-50-5	Chlorine
120-12-7	Anthracene	10049-04-4	Chlorine dioxide
7440-36-0	Antimony	79-11-8	Chloroacetic acid
7440-38-2	Arsenic	532-27-4	2-Chloroacetophenone
1332-21-4	Asbestos (friable)	108-90-7	Chlorobenzene
7440-39-3	Barium	510-15-6	Chlorobenzilate [Benzeneacetic acid, 4-chloro- alpha -(4- chlorophenyl)- alpha -hydroxy-, ethyl ester]
98-87-3	Benzal chloride		
55-21-0	Benzamide	75-00-3	Chloroethane (Ethyl chloride)
71-43-2	Benzene	67-66-3	Chloroform
92-87-5	Benzidine	74-87-3	Chloromethane (Methyl chloride)
98-07-7	Benzoic trichloride (Bensotrichloride)	107-30-2	Chloromethyl methyl ether
98-88-4	Benzoic chloride	126-99-8	Chloroprene
94-36-0	Benzoyl peroxide	1897-45-6	Chlorothalonil [1,3- Benzenedicarbonitrile, 2,4,5,6-tetrachloro-]
100-44-7	Benzyl chloride		
7440-41-7	Beryllium	7440-47-3	Chromium
92-52-4	Biphenyl	7440-48-4	Cobalt
111-44-4	Bis(2-chloroethyl) ether	7440-50-8	Copper
542-88-1	Bis(chloromethyl) ether	120-71-8	p-Cresidine
108-60-1	Bis(2-chloro-1-methylethyl) ether	1319-77-3	Cresol (mixed isomers)
103-23-1	Bis(2-ethylhexyl) adipate	108-39-4	m-Cresol
75-25-2	Bromoform (Tribromomethane)	95-48-7	p-Cresol
74-83-9	Bromomethane (Methyl bromide)	106-44-5	p-Cresol
106-99-0	1,3-Butadiene	98-82-8	Cumene
141-32-2	Butyl acrylate	80-15-9	Cumene hydroperoxide
71-36-3	n-Butyl alcohol	135-20-6	Cupferron [Benzeneamine, N-hydroxy- N-nitroso, ammonium salt]
78-92-2	sec-Butyl alcohol		
75-65-0	tert-Butyl alcohol		
85-68-7	Butyl benzyl phthalate		
106-88-7	1,2-Butylene oxide		
123-72-8	Butyraldehyde		
2650-18-2	C.I. Acid Blue 9, diammonium salt		
3844-45-9	C.I. Acid Blue 9, disodium salt		

B. The TRI List Of Chemicals for 1987 Reporting

110-82-7	Cyclohexane	76-44-8	Heptachlor [1,4,5,6,7,8-Heptachloro-3,4,7,8-tetrahydro-4,7-methano-1H-indene]
94-75-7	2,4-D [Acetic acid, (2,4-dichloro-phenoxy)-]	118-74-1	Hexachlorobenzene
1163-19-5	Decabromodiphenyl oxide	87-68-3	Hexachloro-1,3-butadiene
2903-16-4	Diallate [Carbamothioic acid,bis (1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester]	77-47-4	Hexachlorocyclopentadiene
615-05-4	2,4-Diaminoanisole	67-72-1	Hexachloroethane
39166-41-7	2,4-Diaminoanisole sulfate	1335-87-1	Hexachloronaphthalene
101-80-4	4,4'-Diaminodiphenyl ether	680-31-9	Hexamethylphosphoramide
25376-45-8	Diaminotoluene (mixed isomers)	302-01-2	Hydrazine
95-80-7	2,4-Diaminotoluene	10034-93-2	Hydrazine sulfate
334-88-3	Diasomethane	7647-01-0	Hydrochloric acid
132-64-0	Dibenzofuran	74-90-8	Hydrogen cyanide
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	7664-39-3	Hydrogen fluoride
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	123-31-9	Hydroquinone
84-74-2	Dibutyl phthalate	78-84-2	Isobutyraldehyde
25321-22-6	Dichlorobenzene (mixed isomers)	67-63-0	Isopropyl alcohol
95-50-1	1,2-Dichlorobenzene		(manufacturing-strong acid process, no supplier notification)
541-73-1	1,3-Dichlorobenzene	80-05-7	4,4'-Isopropylidenediphenol
106-46-7	1,4-Dichlorobenzene	7439-92-1	Lead
91-94-1	3,3'-Dichlorobenzidine	58-89-9	Lindane[Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1.alpha.,2.alpha.,3.beta.,4.alpha.,5.alpha.,6.beta.)-]
75-27-4	Dichlorobromomethane	108-31-6	Maleic anhydride
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	12427-38-2	Maneb [Carbamodithioic acid, 1,2-ethanedithiolbis-, manganese complex]
540-59-0	1,2-Dichloroethylene	7439-96-5	Manganese
75-09-2	Dichloromethane (Methylene chloride)	108-78-1	Melamine
120-83-2	2,4-Dichlorophenol	7439-97-6	Mercury
78-87-5	1,2-Dichloropropane	67-56-1	Methanol
542-75-6	1,3-Dichloropropylene	72-43-5	Methoxychlor [Benzene, 1,1'-(2,2-trichloroethylidene)bis [4-methoxy-]]
62-73-7	Dichlorvos [Phosphoric acid, 2 dichloroethenyl dimethyl ester]	109-86-4	2-Methoxyethanol
115-32-2	Dicofol [Benzene, methanol, 4-chloro-alpha.- 4-chlorophenyl)-, alpha.- (trichloromethyl)-]	96-33-3	Methyl acrylate
1464-53-5	Diepoxybutane	1634-04-4	Methyl tert-butyl ether
111-42-2	Diethanolamine	101-14-4	4,4'-Methylenebis(2-chloro anilines) (MBOCA)
117-81-7	Di-(2-ethylhexyl) phthalate (DEHP)	101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzeneamine
84-66-2	Diethyl phthalate	101-68-8	Methylenebis(phenylisocyanate) (MBI)
64-67-5	Diethyl sulfate	74-95-3	Methylene bromide
119-90-4	3,3'-Dimethoxybenzidine	101-77-9	4,4'-Methylenedianiline
60-11-7	4-Dimethylaminoazobenzene	78-93-3	Methyl ethyl ketone
119-93-7	3,3'-Dimethylbenzidine (o-Tolidine)	60-34-4	Methyl hydrazine
79-44-7	Dimethylcarbamyl chloride	74-88-4	Methyl iodide
57-14-7	1,1-Dimethyl hydrazine	108-10-1	Methyl isobutyl ketone
105-67-9	2,4-Dimethylphenol	624-83-5	Methyl isocyanate
131-11-3	Dimethyl phthalate	80-62-6	Methyl methacrylate
77-78-1	Dimethyl sulfate	90-94-8	Michler's ketone
534-52-1	4,6-Dinitro-g-cresol	1313-27-5	Molybdenum trioxide
51-28-5	2,4-Dinitrophenol	505-60-2	Mustard gas [Ethane, 1,1'-thiobis [2-chloro-]]
121-14-2	2,4-Dinitrotoluene	91-20-3	Naphthalene
606-20-2	2,6-Dinitrotoluene	134-32-7	alpha-Naphthylamine
117-84-0	n-Dioctyl phthalate	91-59-8	beta-Naphthylamine
123-91-1	1,4-Dioxane	7440-02-0	Nickel
122-66-7	1,2-Diphenylhydrazine (Hydrazobenzene)	7697-37-2	Nitric acid
106-89-8	Epichlorohydrin	139-13-9	Nitrilotriacetic acid
110-80-5	2-Ethoxyethanol	99-59-2	5-Nitro-g-anisidine
140-88-5	Ethyl acrylate	98-95-3	Nitrobenzene
100-41-4	Ethylbenzene	92-93-3	4-Nitrobiphenyl
541-41-3	Ethyl chloroformate	1836-75-5	Nitrofen [Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-]
74-85-1	Ethylene	51-75-2	Nitrogen mustard [2-Chloro-N-(2-chloroethyl) -N-methylethanamine]
107-21-1	Ethylene glycol	55-63-0	Nitroglycerin
151-56-4	Ethyleneimine (Aziridine)	88-75-5	2-Nitrophenol
75-21-8	Ethylene oxide	100-02-7	4-Nitrophenol
96-45-7	Ethylene thiourea		
2164-17-2	Fluometuron [Urea, N,N-dimethyl-N'-(3-(trifluoromethyl)phenyl)-]		
50-06-0	Formaldehyde		
76-13-1	Freon 113 [Ethane, 1,1,2-trichloro-1,2,2-trifluoro-]		

APPENDICES

79-46-9	2-Nitropropane	68-76-8	Triasiquone [2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-]
156-10-5	p-Nitrosodiphenylamine	52-68-6	Trichlorfon [Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-, dimethyl ester]
121-69-7	N,N-Dimethylaniline	120-82-1	1,2,4-Trichlorobenzene
924-16-3	N-Nitrosodi-n-butylamine	71-55-6	1,1,1-Trichloroethane (Methyl chloroform)
55-18-5	N-Nitrosodiethylamine	79-00-5	1,1,2-Trichloroethane
62-75-9	N-Nitrosodimethylamine	79-01-6	Trichloroethylene
86-30-6	N-Nitrosodiphenylamine	95-95-4	2,4,6-Trichlorophenol
621-64-7	N-Nitrosodi-n-propylamine	88-06-2	2,4,6-Trichlorophenol
4549-40-0	N-Nitrosomethylvinylamine	1582-09-8	Trifluralin [Benzeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)-]
59-89-2	N-Nitrosomorpholine	95-63-6	1,3,4-Trimethylbenzene
759-73-9	N-Nitroso-N-ethylurea	126-72-7	Tris(2,3-dibromopropyl) phosphate
684-93-5	N-Nitroso-N-methylurea	51-79-6	Urethane (Ethyl carbamate)
16543-55-8	N-Nitrosomonicotinic acid	7440-62-2	Vanadium (fume or dust)
100-76-4	N-Nitrosopiperidine	108-05-4	Vinyl acetate
2234-13-1	Octachloronaphthalene	593-80-2	Vinyl bromide
20816-12-0	Osmium tetroxide	75-01-4	Vinyl chloride
56-38-2	Parathion [Phosphorothioic acid, O, O-diethyl-O-(4-nitrophenyl) ester]	76-35-4	Vinylidene chloride
87-86-5	Pentachlorophenol (PCP)	1330-20-7	Xylene (mixed isomers)
79-21-0	Peracetic acid	108-38-3	m-Xylene
108-95-2	Phenol	95-47-6	p-Xylene
106-50-3	p-Phenylenediamine	106-42-3	p-Xylene
90-43-7	2-Phenylphenol	87-62-7	2,6-Xylylene
75-44-5	Phosgene	7440-66-6	Zinc (fume or dust)
7664-38-2	Phosphoric acid	12122-67-7	Zineb [Carbamodithioic acid, 1,2-ethanedithiolbis-, zinc complex]
7723-14-0	Phosphorus (yellow or white)		
85-44-9	Phthalic anhydride		
88-89-1	Picric acid		
1336-36-3	Polychlorinated biphenyls (PCBs)		
1120-71-4	Propane sultone		
57-57-8	beta-Propiolactone		
123-38-6	Propionaldehyde		
114-26-1	Propoxur [Phenol, 2-(1-methylethoxy)-, methylcarbamate]		
115-07-1	Propylene (Propene)		
75-55-8	Propyleneimine		
75-56-9	Propylene oxide		
110-86-1	Pyridine		
91-22-5	Quinoline		
106-51-4	Quinone		
82-68-8	Quintozene [Pentachloronitrobenzene]		
81-07-2	Saccharin (manufacturing, no supplier notification) [1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide]		
94-59-7	Safrrole		
7782-49-2	Selenium		
7440-22-4	Silver		
1310-73-2	Sodium hydroxide (solution)		
7757-82-6	Sodium sulfate (solution)		
100-42-5	Styrene		
96-09-3	Styrene oxide		
7664-93-9	Sulfuric acid		
100-21-0	Terephthalic acid		
79-34-5	1,1,2,2-Tetrachloroethane		
127-18-4	Tetrachloroethylene (Perchloroethylene)		
961-11-5	Tetrachlorovinphos [Phosphoric acid, 2-chloro-1-(2,3,5-trichlorophenyl)ethenyl dimethyl ester]		
7440-28-0	Thallium		
62-55-5	Thioacetamide		
139-65-1	4,4'-Thiodianiline		
62-56-6	Thiourea		
1314-20-1	Thorium dioxide		
7550-45-0	Titanium tetrachloride		
108-88-3	Toluene		
584-84-9	Toluene-2,4-diisocyanate		
91-08-7	Toluene-2,6-diisocyanate		
95-53-4	o-Toluidine		
636-21-5	o-Toluidine hydrochloride		
8001-35-2	Toxaphene		

C. Industries Covered by TRI Reporting Requirements

STANDARD INDUSTRIAL CLASSIFICATION CODES IN USE IN 1987

SIC CODES 20-39

20 Food and Kindred Products

2011 Meat packing plants
 2012 Sausages and other prepared meat products
 2016 Poultry dressing plants
 2017 Poultry and egg processing
 2021 Creamery butter
 2022 Cheese, natural and processed
 2023 Condensed and evaporated milk
 2024 Ice cream and frozen desserts
 2026 Fluid milk
 2032 Canned specialties
 2033 Canned fruits, vegetables, preserves, jams and jellies
 2034 Dried and dehydrated fruits, vegetables, and soup mixes
 2035 Pickled fruits and vegetables, vegetable sauces and seasonings, and salad dressings
 2037 Frozen fruits, fruit juices and vegetables
 2038 Frozen specialties
 2041 Flour and other grain mill products
 2043 Cereal breakfast foods
 2044 Rice milling
 2045 Blended and prepared flour
 2046 Wet corn milling
 2047 Dog, cat and other pet food
 2048 Prepared feeds and feed ingredients for animals and fowls, n.e.c.*
 2051 Bread and other bakery products, except cookies and crackers
 2052 Cookies and crackers
 2061 Cane sugar, except refining only
 2062 Cane sugar refining
 2063 Beet sugar
 2065 Candy and other confectionery products
 2066 Chocolate and cocoa products
 2067 Chewing gum
 2074 Cottonseed oil mills
 2075 Soybean oil mills
 2076 Vegetable oil mills, except corn, cottonseed, and soybean
 2077 Animal and marine fats and oils
 2079 Shortening, table oils, margarine and other edible fats and oils, n.e.c.*
 2082 Malt beverages
 2083 Malt
 2084 Wine, brandy, and brandy spirits
 2085 Distilled, rectified, and blended liquors
 2086 Bottled and canned soft drinks and carbonated waters
 2087 Flavoring extracts and flavoring syrups, n.e.c.*
 2091 Canned and cured fish and seafoods
 2092 Fresh or frozen packaged fish and seafoods
 2095 Roasted coffee
 2097 Manufactured ice
 2098 Macaroni, spaghetti, vermicelli and noodles
 2099 Food preparations, n.e.c.*

21 Tobacco Manufacturers

2111 Cigarettes
 2121 Cigars
 2131 Tobacco (chewing and smoking) and snuff
 2141 Tobacco stemming and redrying

22 Textile Mill Products

2211 Broad woven fabric mills, cotton
 2221 Broad woven fabric mills, man-made fiber and silk
 2231 Broad woven fabric mills, wool (including dyeing and finishing)
 2241 Narrow fabric and other smallwares mills: cotton, wool, silk, and man-made
 2251 Women's full length and knee length hosiery
 2252 Hosiery, except women's full length and knee length hosiery
 2253 Knit outerwear mills
 2254 Knit underwear mills
 2257 Circular knit fabric mills
 2258 Wrap knit fabric mills
 2259 Knitting mills, n.e.c.*
 2261 Finishers of broad woven fabrics of cotton
 2262 Finishers of broad woven fabrics of man-made fiber and silk
 2269 Finishers of textiles, n.e.c.*
 2271 Woven carpets and rugs
 2272 Tufted carpets and rugs
 2279 Carpets and rugs, n.e.c.*
 2281 Yarn spinning mills, cotton, man-made fibers and silks
 2282 Yarn texturizing, throwing, twisting, and winding mills, cotton, man-made fibers and silk
 2283 Yarn mills, wool, including carpet and rug yarn
 2284 Thread mills
 2291 Felt goods, except woven felts and hats
 2292 Lace goods
 2293 Paddings and upholstery filling
 2294 Processed waste and recovered fibers and flock
 2295 Coated fabrics, not rubberized
 2296 Tire cord and fabric
 2297 Nonwoven fabrics
 2298 Cordage and twine
 2299 Textile goods, n.e.c.*

23 Apparel and Other Finished Products made from Fabrics and Other Similar Materials

2311 Men's, youths', and boys' suits, coats and overcoats
 2321 Men's, youths', and boys' shirts (except work shirts), and nightwear
 2322 Men's, youths', and boys' underwear
 2323 Men's, youths', and boys' neckwear
 2327 Men's, youths', and boys' separate trousers
 2328 Men's, youths', and boys' work clothing
 2329 Men's, youths', and boys' clothing, n.e.c.*
 2331 Women's, misses', and juniors' blouses, waists, and shirts
 2335 Women's, misses', and juniors' dresses
 2337 Women's, misses', and juniors' suits, skirts, and coats
 2339 Women's, misses', and juniors', outerwear, n.e.c.*
 2341 Women's, misses', children's, and infants' underwear and nightwear
 2342 Corsets and allied garments
 2351 Millinery
 2352 Hats and caps, except millinery

- 2361 Girls', children's and infants' dresses, blouses, waists and shirts
- 2363 Girls', children's and infants' coats and suits
- 2369 Girls', children's and infants' outerwear, n.e.c.*
- 2371 Fur goods
- 2381 Dress and work gloves, except knit and all leather
- 2384 Robes and dressing gowns
- 2385 Raincoats and other waterproof outer garments
- 2386 Leather and sheep lined clothing
- 2387 Apparel belts
- 2389 Apparel and accessories, n.e.c.*
- 2391 Curtains and draperies
- 2392 Housefurnishings, except curtains and draperies
- 2393 Textile bags
- 2394 Canvas and related products
- 2395 Pleating, decorative and novelty stitching, and tucking for the trade
- 2396 Automotive trimmings, apparel findings, and related products
- 2397 Schiffli machine embroideries
- 2399 Fabricated textile products, n.e.c.*

24 Lumber and Wood Products, Except Furniture

- 2411 Logging camps and logging contractors
- 2421 Sawmills and planing mills, general
- 2426 Hardwood dimension and flooring mills
- 2429 Special products sawmills, n.e.c.*
- 2431 Millwork
- 2434 Wood kitchen cabinets
- 2435 Hardwood veneer and plywood
- 2436 Softwood veneer and plywood
- 2439 Structural wood members, n.e.c.*
- 2441 Nailed and lock corner wood boxes and shooks
- 2448 Wood pallets and skids
- 2449 Wood containers, n.e.c.*
- 2451 Mobile homes
- 2452 Prefabricated wood buildings and components
- 2491 Wood preserving
- 2492 Particleboard
- 2499 Wood products, n.e.c.*

25 Furniture and Fixtures

- 2511 Wood household furniture, except upholstered
- 2512 Wood household furniture, upholstered
- 2514 Metal household furniture
- 2515 Mattresses and bedprings
- 2517 Wood television, radio, phonograph, and sewing machine cabinets
- 2519 Household furniture, n.e.c.*
- 2521 Wood office furniture
- 2522 Metal office furniture
- 2531 Public building and related furniture
- 2541 Wood partitions, shelving, lockers, and office and store fixtures
- 2542 Metal partitions, shelving, lockers and office and store fixtures
- 2591 Drapery hardware and window blinds and shades
- 2599 Furniture and fixtures, n.e.c.*

26 Paper and Allied Products

- 2611 Pulp mills
- 2621 Paper mills, except building paper mills
- 2631 Paperboard mills
- 2641 Paper coating and glazing
- 2642 Envelopes

- 2643 Bags, except textile bags
- 2645 Die cut paper and paperboard and cardboard
- 2646 Pressed and molded pulp goods
- 2647 Sanitary paper products
- 2648 Stationary, tablets and related products
- 2649 Converted paper and paperboard products, n.e.c.*
- 2651 Folding paperboard boxes
- 2652 Set-up paperboard boxes
- 2653 Corrugated and solid fiber boxes
- 2654 Sanitary food containers
- 2655 Fiber cans, tubes, drums, and similar products
- 2661 Building paper and building board mills

27 Printing, Publishing, and Allied Industries

- 2711 Newspapers: publishing, publishing and printing
- 2721 Periodicals: publishing, publishing and printing
- 2731 Books: publishing, publishing and printing
- 2732 Book printing
- 2741 Miscellaneous publishing
- 2751 Commercial printing, letterpress, and screen
- 2753 Commercial printing, lithographic
- 2755 Engraving and plate printing
- 2754 Commercial printing, gravure
- 2761 Manifold business forms
- 2771 Greeting card publishing
- 2782 Blankbooks, looseleaf binders and devices
- 2789 Bookbinding and related work
- 2791 Typesetting
- 2793 Photoengraving
- 2794 Electroforming and stereotyping
- 2795 Lithographic plate-making and related services

28 Chemicals and Allied Products

- 2812 Alkalies and chlorine
- 2813 Industrial gases
- 2816 Inorganic pigments
- 2819 Industrial inorganic chemicals, n.e.c.*
- 2821 Plastics materials, synthetic resins, and non-vulcanizable elastomers
- 2822 Synthetic rubber (vulcanizable elastomers)
- 2823 Cellulosic man-made fibers
- 2824 Synthetic organic fibers, except cellulosic
- 2831 Biological products
- 2833 Medicinal chemicals and botanical products
- 2834 Pharmaceutical preparations
- 2841 Soap and other detergents except specialty cleaners
- 2842 Specialty cleaning, polishing, and sanitation preparations
- 2843 Surface active agents, finishing agents, sulfonated oils and assistants
- 2844 Perfumes, cosmetics, and other toilet preparations
- 2851 Paints, varnishes, lacquers, enamels, and allied products
- 2861 Gum and wood chemicals
- 2865 Cyclic (coal tar) crudes, and cyclic intermediates, dyes, and organic pigments (lakes and toners)
- 2869 Industrial organic chemicals, n.e.c.*
- 2873 Nitrogenous fertilizers
- 2874 Phosphatic fertilizers
- 2875 Fertilizers, mixing only
- 2879 Pesticides, and agricultural chemicals, n.e.c.*
- 2891 Adhesives and sealants
- 2892 Explosives
- 2893 Printing ink
- 2895 Carbon black
- 2899 Chemical and chemical preparations, n.e.c.*

29 Petroleum Refining and Related Industries

- 2911 Petroleum refining
- 2951 Paving mixtures and blocks
- 2952 Asphalt felts and coatings
- 2992 Lubricating oils and greases
- 2999 Products of petroleum and coal, n.e.c.*

30 Rubber and Miscellaneous Plastics Products

- 3011 Tires and inner tubes
- 3021 Rubber and plastic footwear
- 3031 Reclaimed rubber
- 3041 Rubber and plastic hose and belting
- 3069 Fabricated rubber products, n.e.c.*
- 3079 Miscellaneous plastics products

31 Leather and Leather Products

- 3111 Leather tanning and finishing
- 3131 Boot and shoe cut stock and findings
- 3142 House slippers
- 3143 Men's footwear, except athletic
- 3144 Women's footwear, except athletic
- 3149 Footwear, except rubber, n.e.c.*
- 3151 Leather gloves and mittens
- 3161 Luggage
- 3171 Women's handbags and purses
- 3172 Personal leather goods, except women's handbags and purses
- 3199 Leather goods, n.e.c.*

32 Stone, Clay, Glass and Concrete Products

- 3211 Flat glass
- 3221 Glass containers
- 3229 Pressed and blown glass and glassware, n.e.c.*
- 3231 Glass products, made of purchased glass
- 3241 Cement, hydraulic
- 3251 Brick and structural clay tile
- 3253 Ceramic wall and floor tile
- 3255 Clay refractories
- 3259 Structural clay products, n.e.c.*
- 3261 Vitreous china plumbing fixtures and china, and earthenware fittings and bathroom accessories
- 3262 Vitreous china table and kitchen articles
- 3263 Fine earthenware (whiteware) table and kitchen articles
- 3264 Porcelain electrical supplies
- 3269 Pottery products, n.e.c.*
- 3271 Concrete block and brick
- 3272 Concrete products, except block and brick
- 3273 Ready mixed concrete
- 3274 Lime
- 3275 Gypsum products
- 3281 Cut stone and stone products
- 3291 Abrasive products
- 3292 Asbestos products
- 3293 Gaskets, packing and sealing devices
- 3295 Minerals and earths, ground or otherwise treated
- 3296 Mineral wool
- 3297 Nonclay refractories
- 3299 Nonmetallic mineral products, n.e.c.*

33 Primary Metal Industries

- 3312 Blast furnaces (including coke ovens), steel works, and rolling mills
- 3313 Electrometallurgical products

- 3315 Steel wire drawing and steel nails and spikes
- 3316 Cold rolled steel sheet, strip and bars
- 3317 Steel pipe and tubes
- 3321 Gray iron foundries
- 3322 Malleable iron foundries
- 3324 Steel investment foundries
- 3325 Steel foundries, n.e.c.*
- 3331 Primary smelting and refining of copper
- 3332 Primary smelting and refining of lead
- 3333 Primary smelting and refining of zinc
- 3334 Primary production of aluminum
- 3339 Primary smelting and refining of nonferrous metals, n.e.c.*
- 3341 Secondary smelting and refining of nonferrous metals
- 3351 Rolling, drawing, and extruding of copper
- 3353 Aluminum sheet, plate, and foil
- 3354 Aluminum extruded products
- 3355 Aluminum rolling and drawing, n.e.c.*
- 3356 Rolling, drawing, and extruding of nonferrous metals, except copper and aluminum
- 3357 Drawing and insulating of nonferrous wire
- 3361 Aluminum foundries (castings)
- 3362 Brass, bronze, copper, copper base alloy foundries (castings)
- 3369 Nonferrous foundries (castings), n.e.c.*
- 3398 Metal heat treating
- 3399 Primary metal products, n.e.c.*

34 Fabricated Metal Products, except Machinery and Transportation Equipment

- 3411 Metal cans
- 3412 Metal shipping barrels, drums, kegs, pails
- 3421 Cutlery
- 3423 Hand and edge tools, except machine tools and hand saws
- 3425 Hand saws and saw blades
- 3429 Hardware, n.e.c.*
- 3431 Enameled iron and metal sanitary ware
- 3432 Plumbing fixture fittings and trim (brass goods)
- 3433 Heating equipment, except electric and warm air furnaces
- 3441 Fabricated structural metal
- 3442 Metal doors, sash, frames, molding and trim
- 3443 Fabricated plate work (boiler shops)
- 3444 Sheet metal work
- 3446 Architectural and ornamental metal work
- 3448 Prefabricated metal buildings and components
- 3449 Miscellaneous metal work
- 3451 Screw machine products
- 3452 Bolts, nuts, screws, rivets and washers
- 3462 Iron and steel forgings
- 3463 Nonferrous forgings
- 3465 Automotive stampings
- 3468 Crowns and closures
- 3469 Metal stampings, n.e.c.*
- 3471 Electroplating, plating, polishing, anodizing and coloring
- 3479 Coating, engraving and allied services, n.e.c.*
- 3482 Small arms ammunition
- 3483 Ammunition, except for small arms, n.e.c.*
- 3484 Small arms
- 3489 Ordnance and accessories, n.e.c.*
- 3493 Steel springs, except wire
- 3494 Valves and pipe fittings, except plumbers' brass goods
- 3495 Wire springs
- 3496 Miscellaneous fabricated wire products
- 3497 Metal foil and leaf
- 3498 Fabricated pipe and fabricated pipe fittings
- 3499 Fabricated metal products, n.e.c.*

C. Industries Covered by TRI Reporting Requirements

3832 Automatic controls for regulating residential and commercial environments and appliances
3833 Industrial instruments for measurement, display and control of process variables; and related products
3834 Totalizing fluid meters and counting devices
3835 Instruments for measuring and testing of electricity and electrical signals
3839 Measuring and controlling devices, n.e.c.*
3832 Optical instruments and lenses
3841 Surgical and medical instruments and apparatus
3842 Orthopedic, prosthetic and surgical appliances and supplies
3843 Dental equipment and supplies
3851 Ophthalmic goods
3861 Photographic equipment and supplies
3873 Watches, clocks, clockwork, operated devices and parts

39 Miscellaneous Manufacturing Industries

3911 Jewelry, precious metal
3914 Silverware, platedware and stainless steelware
3916 Jewelers' findings and materials and lapidary work
3931 Musical instruments

3943 Dolls
3944 Games, toys and children's vehicles; except dolls and bicycles
3949 Sporting and athletic goods, n.e.c.*
3951 Pens, mechanical pencils and parts
3952 Lead pencils, crayons and artists' materials
3953 Marking devices
3954 Carbon paper and inked ribbons
3961 Costume jewelry and costume novelties, except precious metal
3962 Feathers, plumes and artificial trees and flowers
3963 Buttons
3964 Needles, pins, hooks and eyes and similar notions
3991 Brooms and brushes
3993 Signs and advertising displays
3995 Burial caskets
3996 Linoleum, asphalted-felt-base and other hard surface floor coverings, n.e.c.*
3999 Manufacturing industries, n.e.c.*

*"Not elsewhere classified" indicated by "n.e.c."

D. STATE TRI CONTACTS

TRI forms must be submitted to state-designated offices, as well as to the EPA. Each office listed below should have TRI forms available for public perusal.

Alabama	John Williford, Chief of Operations Alabama Department of Environmental Management Field Operations Division 1751 Federal Drive Montgomery, AL 36109 (205) 271-7951	Connecticut	John Anderson, Chair State Emergency Response Commission Department of Environmental Protection Room 161 165 Capitol Avenue Hartford, CT 06106 (203) 866-4856
Alaska	Alaska Emergency Response Commission Department of Environmental Conservation P.O. Box 0 Juneau, AK 99811-1800 (907) 485-3600	Delaware	Mr. Phillip G. Retallick Division of Air and Waste Management Department of Natural Resources and Environmental Control Richardson and Robbins Building 89 Kings Highway Dover, DE 19901 (302) 736-4764
American Samoa	Mr. Pati Faisi Director, American Samoa Environmental Protection Agency Office of the Governor Pago Pago, American Samoa 96799 (684) 633-3683	District of Columbia	Ms. Pamela Thurber Environmental Planning Specialist Office of Emergency Preparedness 2000 14th Street, NW, 18th Floor Washington, D.C. 20009 (202) 727-6161
Arizona	Carl F. Funk, Executive Director Arizona Emergency Response Commission (AERC) 5636 East McDowell Road Phoenix, AZ 85008 (602) 244-0504	Florida	Thomas G. Pelham, Chairman Florida Emergency Response Commission Florida Department of Community Affairs 2740 Centerview Drive Tallahassee, FL 32309 (904) 487-4915
Arkansas	Mr. John Ward Department of Pollution Control and Ecology 8001 National Drive P.O. Box 9583 Little Rock, AR 72209 (501) 562-7444	Georgia	Jimmy Kirkland Georgia Department of Natural Resources 205 Butler Street, S.E. Floyd Towers East Atlanta, GA 30334 (404) 656-6905
California	Charles H. Shulock Assistant to the Secretary Office of Environmental Affairs Attn: Section 313 Reports P.O. Box 3815 Sacramento, CA 95812 (916) 324-8124	Guam	Charles P. Crisostomo Administrator, Guam Environmental Protection Agency P.O. Box 2999 Agana, Guam 96910 (671) 646-8863
Colorado	Pam Harley Colorado Department of Health Division of Hazardous Materials and Waste Management 4310 East 11th Avenue Denver, CO 80220 (303) 331-4858	Hawaii	John C. Lewin, M.D., Director Hawaii State Department of Health P.O. Box 3378 Honolulu, HI 96801 (808) 548-6505
Commonwealth of the Northern Mariana Islands	Russell Meecham, III Chief, Division of Environmental Quality P.O. Box 1504 Saipan, Commonwealth of the Northern Mariana Islands 96950 (670) 234-6084	Idaho	Jennie Records, Program Coordinator Idaho Emergency Response Commission State House Boise, ID 83720 (208) 334-5898

D. STATE TRI CONTACTS

Illinois	Mr. Joe F. Goodner, P.E. Office of Chemical Safety Illinois Environmental Protection Agency P.O. Box 19276 2200 Churchill Road Springfield, IL 62794-9276 (217) 782-3637	Michigan	Mr. David Warner Title III Coordinator Michigan Department of Natural Resources Environmental Response Division P.O. Box 30028 Lansing, MI 48909 (517) 373-8481
Indiana	Mr. Philip Powers, Staff Director Indiana Emergency Response Commission Indiana Department of Environmental Management Management Office of Emergency Response 5500 West Bradbury Avenue Indianapolis, IN 46241 (317) 243-5167	Minnesota	Mr. Lee Tischler Director of Emergency Response Commission Minnesota Department of Public Safety Room B5, State Capitol St. Paul, MN 55155 (612) 296-0481
Iowa	Mr. Jim Taylor Iowa Emergency Response Commission 301 E. 7th Street Des Moines, IA 50319 (515) 281-6175	Mississippi	Mr. J.E. Maher Mississippi Emergency Management Agency P.O. Box 4501, Fondren Station Jackson, MI 39216-0501 (601) 352-9100
Kansas	Right-to-Know Program Kansas Department of Health and Environment Building 740, Forbes Field Topeka, KS 66620-7430 (913) 296-1690	Missouri	Mr. Dean Martin Missouri Emergency Response Commission P.O. Box 3133 Jefferson City, MO 65102 (314) 751-7929
Kentucky	James H. "Mike" Molloy, Chairman Kentucky Emergency Response Commission E.O.C. Building, Boone Center Parking Drive Frankfort, KY 40601 (502) 564-8682	Montana	Tom Elleroff Montana Department of Health and Environmental Sciences Cogswell Building, A-107 Helena, MT 59620 (406) 444-3948
Louisiana	Mr. R. Bruce Hammatt Emergency Response Coordinator Department of Environmental Quality Office of Water Resources P.O. Box 44091 Baton Rouge, LA 70804-4091 (504) 342-6363	Nebraska	Mr. Craig Bagstad Technical Services Section Nebraska Department of Environmental Control P.O. Box 98922 Lincoln, NE 68509-8922 (402) 471-4230
Maine	David Brown, Director Maine Emergency Management Agency State House Station 72 State Office Building Augusta, ME 04333 (207) 289-4080	New Hampshire	Richard H. Strome, Director New Hampshire Governor's Office of Emergency Management 107 Pleasant Street Concord, NH 03301 (603) 271-2231
Maryland	Max Eisenberg, Ph.D. Assistant Secretary for Toxics, Environmental Science and Health Maryland Department of the Environment 201 W. Preston Street Baltimore, MD 21201 (301) 225-5780	New Jersey	New Jersey Department of Environmental Protection Division of Environmental Quality - CN 405 Richard A. Dime, Ph.D., Chief Bureau of Hazardous Information SARA Title III Section 313 401 East State Street Trenton, NJ 08625 (609) 292-6714
Massachusetts	Arnold Sapenter Department of Environmental Quality Engineering One Winter Street, 9th Floor Boston, MA 02108 (617) 556-1029	New Mexico	Mr. Neal Scheidel, Chairman State Emergency Response Commission 4491 Cerrillos Road P.O. Box 1628 Santa Fe, NM 87501 (505) 827-3375

APPENDIXES

New York	New York Department of Environmental Conservation Bureau of Spill Response SARA Title III Section 313 50 Wolf Road Albany, NY 12233 (518) 467-4107	Rhode Island	Department of Environmental Management Division of Air and Hazardous Materials 304 Cannon Building 78 Davis Street Providence, RI 02908 (401) 277-2808
Nevada	Bob King, Director Division of Emergency Management 2625 South Carson Carson City, NV 89710 (702) 885-4340	South Carolina	Stan M. McKinney, Chairman South Carolina Emergency Response Commission Division of Public Safety Programs Office of the Governor 1205 Pendleton Street Clemson, SC 29631 (803) 734-0435
North Carolina	Vance E. Kee North Carolina Division of Emergency Management 116 West Jones Street Raleigh, NC 27603-1335 (919) 733-3867	South Dakota	South Dakota Department of Water and Natural Resources Joe Foss Building 523 East Capitol Pierre, SD 57501 (605) 773-3151
North Dakota	North Dakota State Department of Health and Consolidated Laboratories P.O. Box 5520 Bismarck, ND 58502-5520 (701) 224-2374	Tennessee	Lacy Suiter, Chairman Tennessee Emergency Response Council Tennessee Emergency Management Agency 3041 Sidco Drive Nashville, TN 37204-1502 1-800-262-3300 (In State) 1-800-258-3300 (Out of State)
Ohio	Mr. Steven Grossman, Assistant Director Ohio Environmental Protection Agency Office of Emergency Response P.O. Box 1049 1800 WaterMark Drive Columbus, OH 43266-0149 (614) 481-7050	Texas	David Barker, Supervisor Emergency Response Unit Texas Water Commission P.O. Box 13087 Capitol Station Austin, TX 78711 (512) 463-7727
Oklahoma	Jack W. Muse Hazardous Materials Planning Coordinator Oklahoma Civil Defense Division P.O. Box 53365 Oklahoma City, OK 73152 (405) 521-2481	Utah	Montie Keller Utah Department of Health Division of Environmental Health P.O. Box 45500 288 North 1460 West Salt Lake City, UT 84116-0700 (801) 538-6121
Oregon	Oregon State Fire Marshal Hazardous Materials Section 3000 Market Street Plaza Salem, OR 97310 (503) 378-2885	Vermont	Paul Dailey, Deputy Commissioner Department of Health 60 Main Street Burlington, VT 05401 (802) 863-7281
Pennsylvania	Mr. James Tinney Pennsylvania Emergency Response Commission c/o Bureau of Right-to-Know Room 1503 Labor and Industry Bldg. Harrisburg, PA 17120 (717) 783-8150	Virginia	Mr. Wayne Halbleib Department of Waste Management James Monroe Building, 11th Floor 101 North 14th Street Richmond, VA 23219 (804) 786-3017
Puerto Rico	Santos Rohena, SERC Commissioner Title III - SARA Section 313 Puerto Rico Environmental Quality Board P.O. Box 11488 San Juan, PR 00910 (809) 724-6045	Virgin Islands	Alan D. Smith, Commissioner Department of Planning and Natural Resources 179 Altona and Weigunst St. Thomas, VI 00800 (809) 774-3320

D. STATE TRI CONTACTS

Washington	Sally Toteff Washington State Department of Ecology P. V. - 11 Olympia, WA 98504 (206) 459-6303	Wisconsin	Mr. Richard I. Braund, Administrator Division of Emergency Government Department of Administration 4802 Sheboygan Avenue P.O. Box 7865 Madison, WI 53707 (608) 266-3232
West Virginia	Mr. William Pinnell Office of Environmental Health Services West Virginia Department of Health 1800 East Washington St., Room 507 Charleston, WV 25305 (304) 348-2901	Wyoming	Ed Usui, Executive Secretary State Emergency Response Commission Wyoming Emergency Management Agency 5500 Bishop Blvd. Cheyenne, WY 82009 (307) 777-7566

Notes: (1) If an Indian tribe has chosen to act independently of a state for the purpose of section 313 reporting, facilities located within that Indian community should report to the tribal SERC, or until the SERC is established, the Chief Executive Officer of the Indian tribe, as well as to EPA; (2) Facilities located within the Territories of the Pacific should send a report to the Chief Administrator of the appropriate territory, as well as to EPA.

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[Notes: (1) If an Indian tribe has chosen to act independently of a state for the purpose of section 313 reporting, facilities located within that Indian community should report to the tribal SERC, or until the SERC is established, the Chief Executive Officer of the Indian tribe, as well as to EPA; (2) Facilities located within the Territories of the Pacific should send a report to the Chief Administrator of the appropriate territory, as well as to EPA.]

E. GETTING ACCESS TO TRI DATA ON THE NATIONAL LIBRARY OF MEDICINE'S TOXNET SYSTEM



TRI

TOXIC CHEMICAL RELEASE INVENTORY

FACT

NATIONAL
LIBRARY of
MEDICINE

SHEET

TRI DEFINED

TRI (the Toxic Chemical Release Inventory) contains information on the annual estimated releases of toxic chemicals to the environment. Based upon data collected by the Environmental Protection Agency (EPA), this file is publicly accessible on the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET).

TRI BACKGROUND

Mandated by Title III of the SUPERFUND Amendments and Reauthorization Act (SARA) of 1986, the Inventory contains provisions for the reporting, by industry, on the releases of over 300 toxic chemicals into the air, water, and land. Data submitted to EPA include names and addresses of facilities which manufacture, process, or otherwise use these chemicals, as well as amounts released to the environment or transferred to waste sites. Title III, also known as the Emergency Planning and Community Right-to-Know Act, calls for the EPA to collect this data nationwide on an annual basis. The Law mandates that the data be made publicly available through a computer database. The online TRI file should appeal to a broad based user audience including industry, state and local environmental agencies, emergency planning committees, the Federal Government, and other regulatory groups. Another important user group is likely to be concerned citizens who, on their own or through public interest groups and public libraries, can use TRI to ask questions about chemical releases in their communities.

TRI FILE STRUCTURE

TRI data is arranged in the following broad categories:

- Facility Identification
- Substance Identification
- Environmental Release of Chemical
- Waste Treatment
- Off-Site Waste Transfer

The data include the names, addresses and public contacts of plants manufacturing, processing or using the reported chemicals, the maximum amount stored on site, the estimated quantity emitted into the air (point and non-point emissions), discharged into bodies of water, injected underground, or released to land, methods used in waste treatment and their efficiency, and data on the transfer of chemicals off-site for treatment/disposal, either to publicly owned treatment works or elsewhere.

E. GETTING ACCESS TO TRI DATA ON THE NATIONAL LIBRARY OF MEDICINE'S TOXNET SYSTEM

SEARCHING TRI

TRI is a component file of NLM's TOXNET system. Utilizing a free text search capability, full Boolean logic, a powerful and flexible command language and a variety of online user assistance features, TOXNET offers state-of-the-art user-friendly searching. Online and offline printing of entire or specified portions of records is available, as are a variety of customized print options. Special **TRI** features allow sorting and numerical manipulation of data. A menu-driven search package also allows novice users or individuals with limited computer skills to search **TRI** efficiently.

TRI IN ACTION

TRI users can ask such questions as:

- How much benzene was reported released to waterways in 1987 by Virginia industrial plants?
- What waste minimization methods are reported by Marin County manufacturers of toluene?
- How much chlorine gas have entire plants of Company XYZ released into the air last year throughout the country?
- What are the names and addresses of Baltimore steel plants importing lead?
- What quantity of sulfuric acid at Boston's ABC Waste Treatment Facility is transferred there from outside the State of Massachusetts?

TRI AVAILABILITY

TRI is available 24 hours/day, 7 days/week, except for a brief daily maintenance period.

TRI ACCESS

Registered NLM online services users are able to access **TRI** on the TOXNET system by direct dial or through various telecommunication networks including TELENET, TYMNET, or COMPUSERVE. **TRI** users also automatically have access to all TOXNET files and can access other NLM files, through the TOXNET Gateway. In addition to **TRI**, TOXNET contains HSDB (Hazardous Substances Data Bank), RTECS (Registry of Toxic Effects of Chemical Substances), CCRIS (Chemical Carcinogenesis Research Information System), ETICBACK (Environmental Teratology Information Center Backfile), EMIC BACK (Environmental Mutagen Information Center), and DBIR (Directory of Biotechnology Information Resources). Other NLM files, such as the TOXLINE/TOXLIT group, containing some 2.5 million references on literature related to toxic chemicals, may be used to obtain supporting information in such areas as health hazards and emergency handling of **TRI** chemicals.

TRI USER SERVICES

For further information about the **TRI** file, contact:

TRI Representative
Specialized Information Services
National Library of Medicine
8600 Rockville Pike
Bethesda, MD 20894
Telephone (301) 496-6531

JUNE 1989

F. OTHER EPA PUBLICATIONS ON TRI

The following documents are available from EPA pertaining to the Toxics Release Inventory. To obtain a copy, circle the reports desired on this page (or a photocopy) and mail it with your name and address to:

**Emergency Planning and Community Right-to-Know
Document Distribution Center, P.O. Box 12505,
Cincinnati, Ohio 45212.**

- TRI Reporting Package (EPA 560/4-89-001)
- Title III Section 313 (TRI) Reporting Form R and Instructions (EPA 560/4-88-005)
- TRI Magnetic Media Submission Guidance Package (EPA 560/7-88-003)
- Toxic Chemical Release Inventory Questions and Answers (EPA 560/4-89-002)
- Common Synonyms for Section 313 (TRI) Chemicals (OTS-ETD-001)
- Supplier Notification Requirements Brochure (EPA 560/4-89-003)

Also available is the EPA's technical guidance on ESTIMATING RELEASES (EPA 560/4-88-002) is available from: The Government Printing Office, Washington, D.C. 20402-9325, (202) 783-3238, Stock number 055-000-00270-3, \$11.00.

The COMPLETE TRI INVENTORY is available on magnetic tape with documentation from the National Technical Information Service (NTIS), (703) 487-4650. Order number PB89-186068. Specify ASCII or EBCDIC format. Price is \$1,025 for 1600 BPI density; \$525 for 6250 BPI density.

About this Report

Much of this report was prepared and produced using widely-available software on IBM and IBM-compatible personal computers.

Toxics Release Inventory data were retrieved from the March 15, 1988, version of EPA's TRIS database using software on the Agency's mainframe computers. The data were imported into and analyzed with Lotus 1-2-3. Final tabular data presentations were developed using Microsoft Excel (PC version), and graphical data presentations (pie charts and bar charts) were generated with Harvard Graphics.

Detailed U.S. county maps and the Chesapeake Bay region maps — the only part of the report **not** produced with personal computers — were constructed on EPA's IBM-3090 mainframe computer using programs developed in SAS. All remaining maps were produced with Lotus Freelance Plus. (Because the standard Freelance maps do not include Puerto Rico or other U.S. territories, these jurisdictions could not be displayed on the maps herein.)

Word processing was performed using WordPerfect 5.0. Layout and typesetting for the entire report were done with Xerox Ventura Publisher (Version 2.0).

For more information on the data analysis and production methods used in this report, contact

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Alexandria, VA 22309
(703) 683-6695